Practical Computing

80p

December 1982

Volume 5 Issue 12

Monopoly on
a micro
BBC memory
secrets

Reviews:
Vic-20 Wordcraft
Apple GraForth
Atari games
Eagle II

Buyers'
guides:
Micros under
£200
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Monopoly on a micro — page 114

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2732-450n	380
2764	999
3242	590
4027	190
4116-150	85
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4118-250	325
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6800	225
6802	250
6803	850
6804	160
6805	670
6808	520
6809	630
6810	115
6820	100
6821	100
68B21	220
6840	375
6843	£12
6845	685
6847	650
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81LS97	80
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18	£225
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8156	350
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8212	110
8214	425
8215A-300	300
8216	100
8224	110
8226	250
8228	220
8243	270
8250	850
8251	250
8253	400
8255	295
8256A	£35
8257	400
8259	395
8271	£36
8279	385
8284	350
8288	£11
8T26A	99
8T27	150
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9364AP	550
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AM26LS31C	125
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AY-3-890	£438
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Z80SIO-1	850
Z80ASIO	980
ZN419CE	190
ZN423E	138
ZN424E	130
ZN425E-8	345
ZN426E-8	300
ZN427E-8	590
ZN428E	410
ZN429E-8	210
ZN459	570
ZN1034E	200
ZN1040E	675
ZNA234E	850

74S Series

74S00	30
74S02	32
74S03	32
74S08	40
74S10	40
74S20	40
74S27	40
74S32	70
74S74	75
74S112	90
74S132	110
74S133	60
74S138	125
74S139	150
74S155	39
74S158	195
74S175	260
74S188	210
74S189	158
74S194	320
74S201	350
74S225	525
74S240	390
74S241	390
74S260	50
74S262	850
74S287	300
74S288	210
74S289	290
74S301	000
74S365	000
74S3745	365
74S470	325
74S471	620
74S472	1150
74S475	825
74S571	620

75 Series

75107/8	95
75110	90
75150/54	125
75182/3	99
75188/9	55
7532	140
75450	86
75451/2	52
75454	70
75491/2	65

TTL74

7400	11
7402	11
7404	13
7410	14
7411	15
7423	18
7414	20
7420	15
7422	20
7427	18
7430	14
7442	32
7447	40
7448	40
7473	24
7474	20
7475	25
7485	60
7486	20
7489	170
7490	20
7491	35
7492	25
7493	25
74100	80
74116	50
74121	25
74125	35
74126	35
74143	210
74148	60
74150	50
74151	40
74153	40
74154	55
74186	470
74188	250
74383	99

74 LS

LS00	11
LS02	11
LS04	12
LS08	12
LS10	13
LS13	20
LS14	26
LS19	58
LS20	13
LS22	12
LS27	12
LS32	13
LS30	12
LS42	28
LS47	35
LS48	55
LS63	120
LS73	18
LS74	18
LS75	20
LS85	42
LS86	16
LS90	24
LS91	60
LS92	32
LS93	23
LS125	24
LS126	25
LS138	25
LS139	28
LS148	70
LS151	40
LS153	40
LS156	36
LS157	27
LS158	30
LS175	50
LS240	55
LS241	55
LS242	55
LS243	55
LS244	55
LS245	70
LS273	54
LS373	60
LS374	55
LS393	42
LS471	629
LS640	180
LS641	180
LS645	180
LS668	125
LS669	120
LS670	100
LS673	550

CMOS

4000	10
4001	10
4002	12
4007	14
4008	32
4009	24
4010	24
4011	10
4012	16
4013	20
4016	20
4017	32
4018	45
4022	40
4023	13
4024	32
4025	13
4026	80
4027	20
4028	39
4029	45
4030	15
4040	40
4041	40
4042	44
4043	40
4044	40
4049	25
4050	25
4051	45
4052	60
4053	50
4060	45
4066	24
4068	14
4069	13
4071	13
4072	13
4075	13
4076	50
4077	13
4078	15
4081	13
4082	13
4093	20
4094	70
4095	95
4096	70
4097	190
4098	75
4099	75
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4411	690
4412	790
4502	60
4503	35
4511	46
4519	30
4539	90
4549	375
4572	36
4583	99
4584	48
4585	99
4597	330
4598	290
4599	290
40100	215
40104	95
40105	115
40106	75
40107	60
40108	450
40109	100
40110	300
40114	240
40163	50
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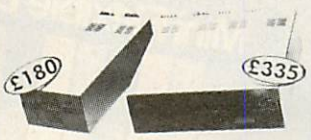

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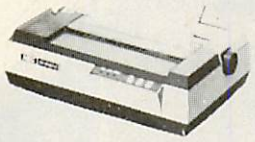
NEC PC8023-C



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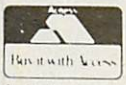

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1·6MHz	392	18·432M	150
1·8MHz	395	19·968M	150
1·843M	200	20·0MHz	200
2·0MHz	225	24·0MHz	170
3·2768M	150	24·930M	325
3·57594	98	48·0M	175
3·6864M	300	100·0M	375
4·0MHz	150		
4·433619	100		
5·0MHz	160		
6·0MHz	140		
6·144MHz	150		
6·5536M	200		
7·0MHz	150		
7·168MHz	160		
7·68MHz	200		
8·0MHz	150		
9·0MHz	200		
9·375M	350		
10·0MHz	175		
10·7MHz	150		
10·24MHz	200		
12·0MHz	175		
12·528M	300		
14·31818	170		

WEMON

Watford's specially designed 4K Ultimate Monitor IC for UK101 & Superboard

Onlv £10.

IDC CONNECTORS

Speed block type	PCB Plug with latch Strt Pins	PCB Plug with latch Angle Pins	Female Header Socket	Unshrouded PCB Plugs Stt pins	Unshrouded PCB Plugs Angle pins
10 way	90p	99p	85p	60p	65p
16 way	130p	150p	110p	70p	78p
20 way	145p	166p	125p	80p	92p
26 way	175p	200p	150p	95p	110p
34 way	205p	236p	160p	110p	135p
40 way	220p	250p	190p	125p	150p
50 way	235p	270p	200p	150p	175p

JUMPER LEADS Ribbon Cable Assembly DIL PLug (Headers)

Single Ended Lead 24" Long

Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	380p

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6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

IDC female receptacle jumper leads

	20way	26way	34way	4way
24" 1 end	160p	200p	260p	300p
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DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	22p	60p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey	Colour
	Price per Foot	
10	12p	22p
16	25p	32p
20	25p	40p
26	35p	52p
34	48p	60p
40	55p	70p
60	75p	115p

DIL PLUGS (Headers)

	Solde	IDC
14pin	38p	95p
16pin	42p	100p
24pin	88p	130p
40pin	195p	218p

AMPHENOL PLUGS

24way IEEE	575p
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24way	575p
28way	850p
40way	975p

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DIN41617 31way 41612 A+B	170p	—	—	175p
2×32way 41612 A+C	285p	325p	220p	295p
2×32way 41612 A B C	300p	325p	240p	300p
3×32way	360p	385p	260p	400p

EDGE CONNECTORS

TWO ROWS		
2×10way		135p
2×15way		140p
2×18way	180p	145p
2×22way	199p	200p
2x23way	195p	
2x25way	225p	
2x28way	210p	
2x30way	245p	
2x36way	295p	
2x40way	315p	
2x43way	395p	

D CONNECTORS Miniature

Male	9 way	15 way	25 way	37 way
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
Female				
Solder	110p	160p	210p	350p
Angle	165p	215p	290p	440p
Pins	150p	180p	240p	420p
Covers	100p	95p	100p	110p

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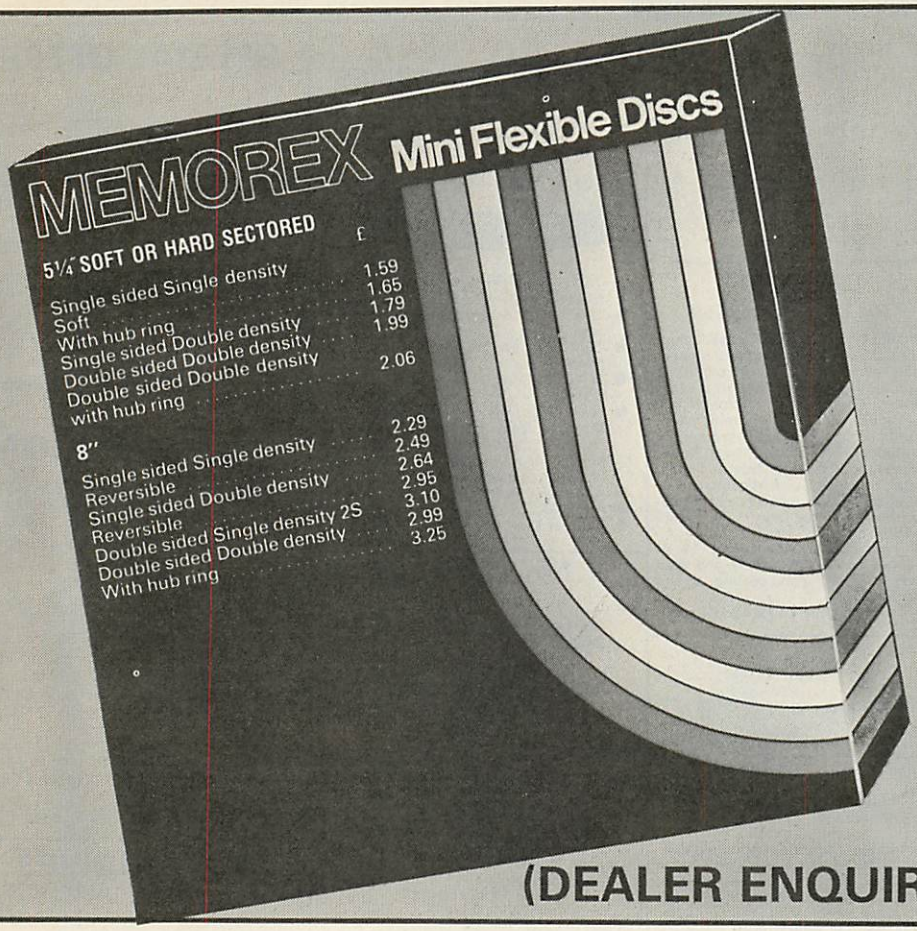
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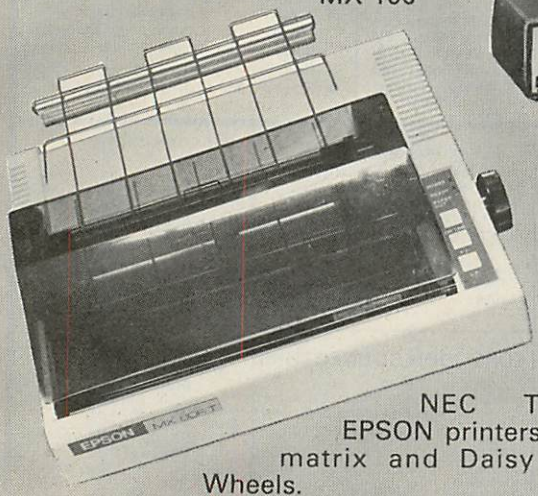

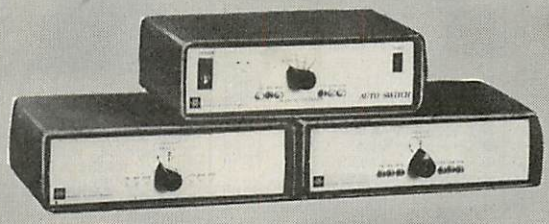

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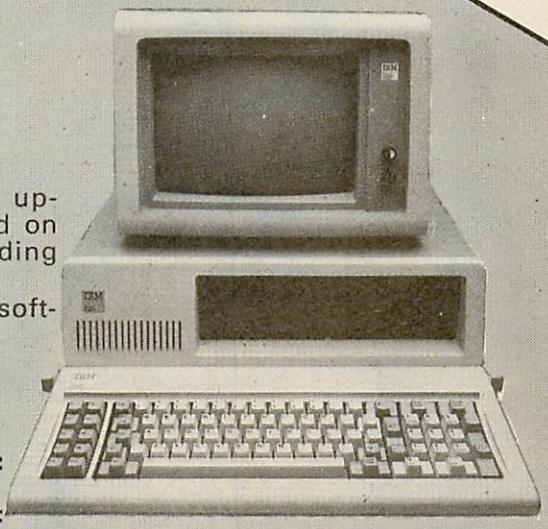

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Daisywriter's proprietry Z80-based Computer-Optimized Printer Interface and Emulation System (COPIES) provides the most powerful features that you will find in any letter-quality printer.

Protocol Emulation for Diablo 630, Qume Sprint 9, NEC 3510, Atari 825 and IBM PC.

Built-in Buffer Memory of 4K, 16K or 48 Kbytes. Computers with single task limitations can **spool** by loading up the buffer memory in less than a second and print for up to an hour with the optional low-cost tractor or sheet feeder. While printing, the host computer can be used for other operations. Clear Buffer and Reprint Buffer commands may be controlled by the front panel or software.

CRT Hard Copy Printout allows dumping the full screen display of a CRT instantly and directly to Daisywriter.

Computer Compatibility is easily accomplished through a selection of 50 interface signals and a matching computer cable for immediate plug-to-plug compatibility. Four interfaces are available in the Daisywriter including Centronics 8 bit parallel, IEEE-488, RS-232C and 20 ma Current Loop.

Special Diagnostic Protocol prints incoming software commands in hex code underlined, in addition to printing the text – a powerful software debugging tool.

Special Daisykey Protocol substitutes "!" (or any other character) for "ESC", and allows microcomputers that normally cannot issue ESC or control codes to send these commands to Daisywriter.

Software Commands (more than 65) are recognised by Daisywriter, including most word processing functions. Daisywriter is almost a word processor!

Automatic Margin Justification includes automatic centring and changed margin limits under software command.

Automatic True Proportional Spacing uses an internal character spacing table optimized to Linotype printing standards, which may be changed by software command. No need for special proportional spacing printwheels!

Graphics include absolute and relative vector plotting for easy creation of charts and graphs. It's compatible with Diablo HYPLOT.

Automatic Baud Rate Selection automatically adapts to the incoming baud rate from 50 to 19,200 baud (16 baud rates may also be selected by dip switches or software command).

Automatic RS-232C Protocol Selection automatically adapts to either ETX/ACK or DC1/DC3 (X ON/OFF) protocols of EIA RS-232C.

Pitch and Line Space Selection enables a choice of 10, 12 or 15 characters per inch pitch and 1, 1½ or 2 lines-per-line-feed by front panel switches or software command.

Form Length Selection from 10 to 109 lines can be accomplished by a thumbwheel switch located on the front panel, or 1 to 255 lines using software control. Forms or cut sheets can be printed on line 1 if required.

Self Diagnostic Test completely tests the printer and four internal CPU's, printing a sliding pattern of 8 lines and then halts. On power up, a green LED goes on only after all RAM's ROM's and CPU's have passed a diagnostic test.

Error Indicators include a red LED and two audible alarm rates which are activated when the printer is in an error mode: paper-out, ribbon-out, printwheel misalignment or printer jam activate a faster, urgent audible rate. Cover open, framing, parity or overrun errors activate a slower, less urgent, audible rate. The audible alarm can be disabled from the front panel.

24 DIP Switches are easily accessible from the front panel allowing selection of all interface and protocol compatibility functions (including PET device addressing).

Paper Handling optional snap on/off tractors and sheet feeder.

Most Reliable...

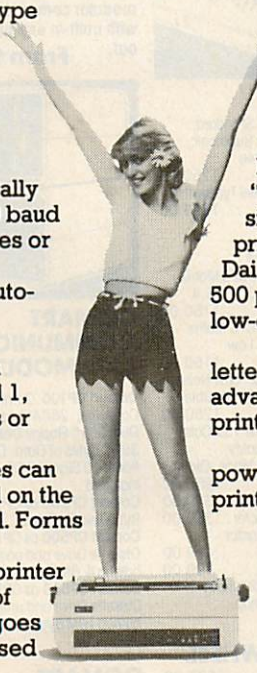
Simple Design is expressed in Daisywriter's carriage movement. A linear stepping motor magnetically drives the carrier along a rugged stainless steel track. There are no cables, belts, wheels or pulleys to fail, stretch, adjust or malfunction. In addition, three CPU's are utilized to reduce the complexity and number of mechanical parts, contributing to an unusually long life of trouble-free operation.

Modular Construction consists of only five units: platen, carrier, controller, power supply and interface-emulator-buffer memory board. Loosening two captive screws allows the cover to be removed for on-site replacement of these modules in minutes. All cables between modules are terminated through connectors for quick disconnect.

Printwheel Cassettes were first introduced by Daisywriter. Printwheels are enclosed in protective, self-aligning, easily-changed plastic cassettes. The protective cassettes prevent damage or breakage of the printwheel pedals. They are available in 12 print styles and 15 languages.

Standard IBM Ribbon Cartriges, known for their reliability, are used by Daisywriter. A ribbon-out sensor informs the operator by both a visual and audible alarm.

Production-Proven and Field Tested. Daisywriter's reliable printing mechanism has been in production nearly two years. Daisywriter's powerful proprietary built-in system which incorporates hardware interfaces, protocol emulation, software and buffer has been designed and is manufactured by Computers International, a 5 year old California computer peripherals company. This combination of a simple, reliable printer mechanism and the advanced single-board computerized system contribute to Daisywriter's extremely high reliability.



Most Cost-Effective...

High-Speed Throughput is accomplished by utilizing a large buffer memory and special firmware. Daisywriter zips along at up to 200 cps through all "white space", with paper and carriage moving simultaneously, thus increasing effective throughput printing speed up to 40 cps in typical applications. Daisywriter's high speed allows the user to print up to 500 pages in a normal 8 hour day using an optional low-cost sheet feeder or tractor.

Low Cost! At much less than the cost of other letter-quality printers that lack most of Daisywriter's advanced features, it is easy to see that on a cost-per-printed-document comparison, Daisywriter is the winner!

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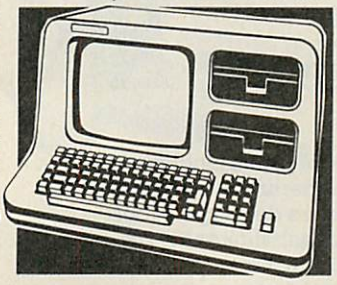

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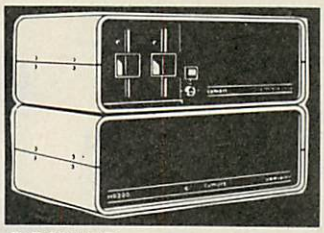

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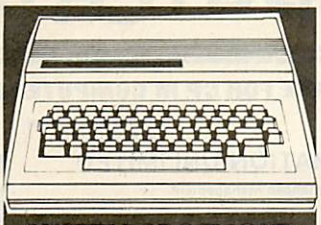

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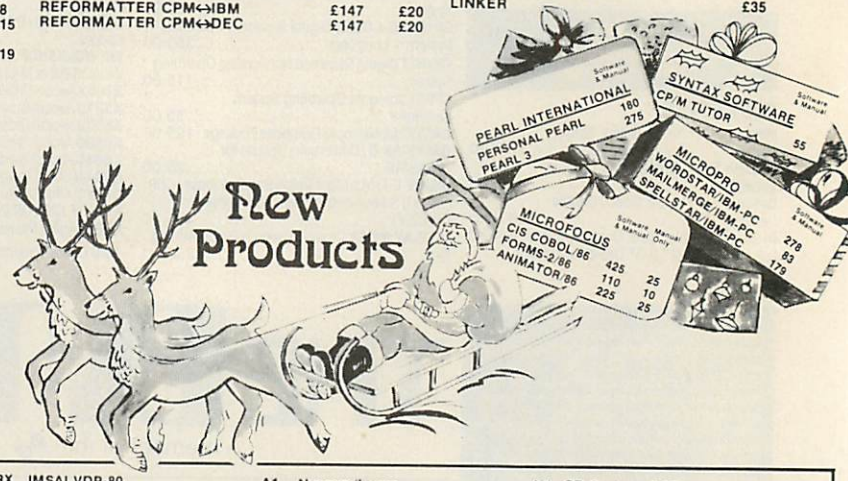

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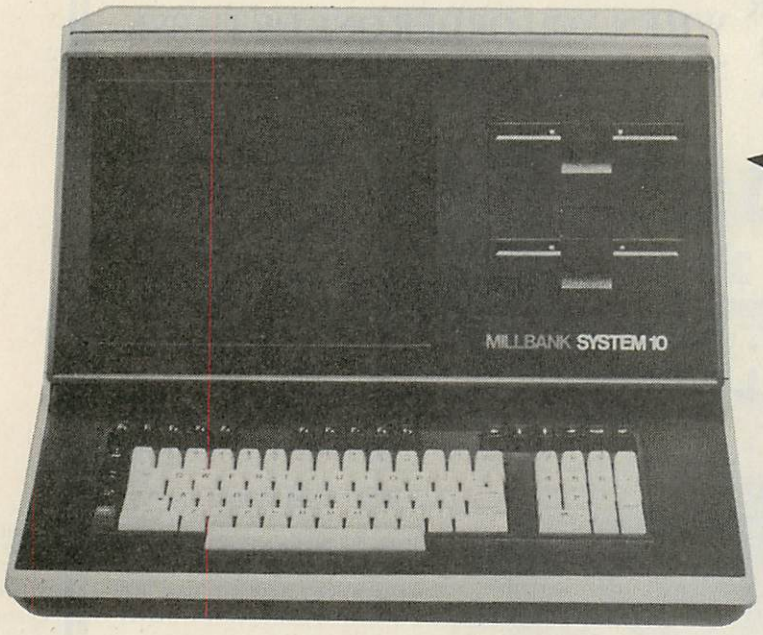

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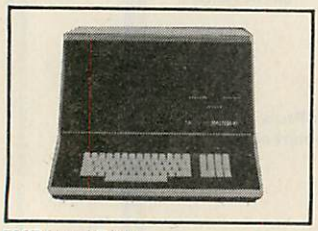
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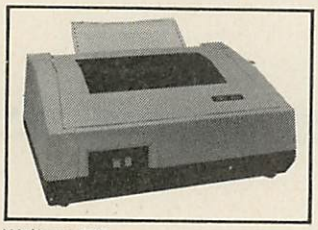
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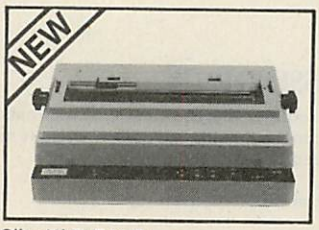

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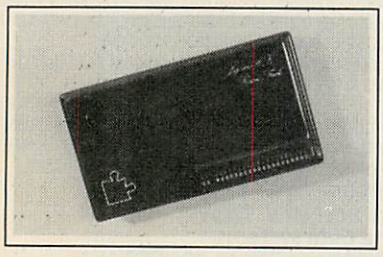

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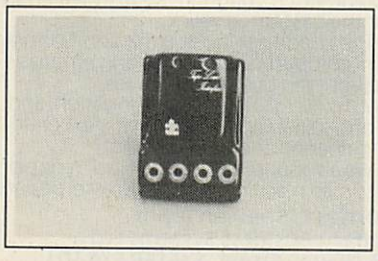
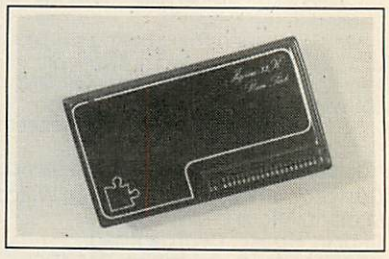


Tape loading Interface giving constant output levels to your ZX, regardless of input levels from your tape cassette.



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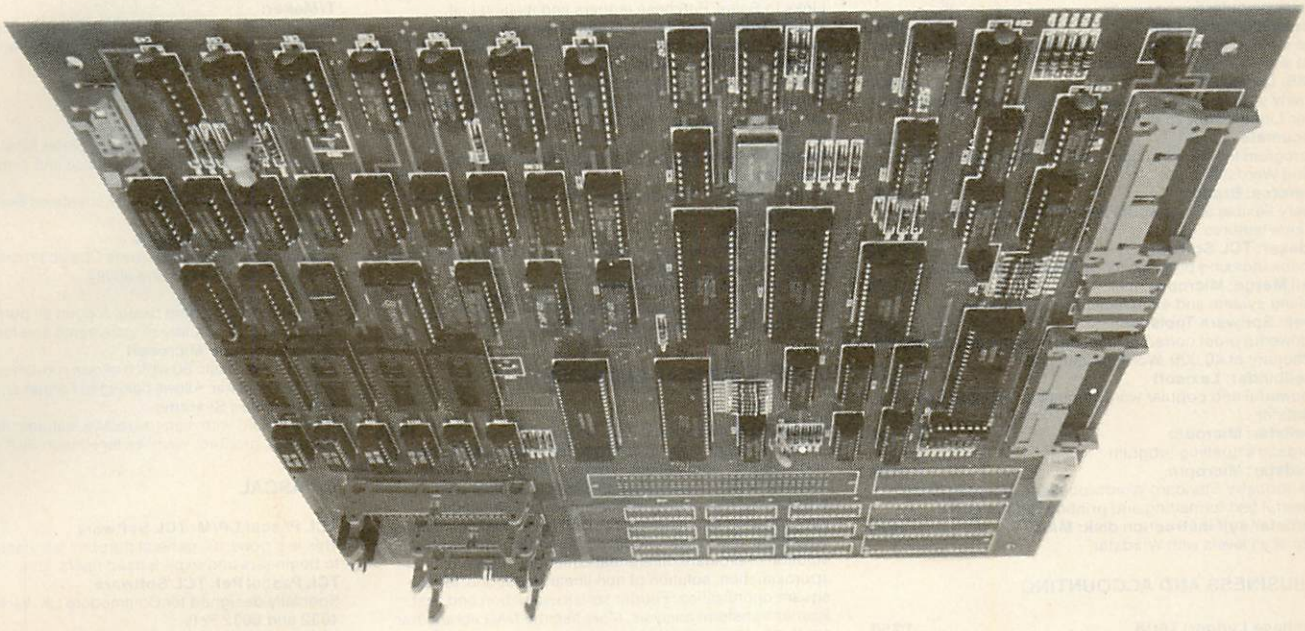

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Sam: Software International £280
A statistics package with all the usual routines, plus facility for handling missing variables
Calcstar: Micropro £120
Financial modelling package linked to Wordstar.
Editroom £275
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Fastplan: Comshare £395
An easy to use but very sophisticated financial modelling package.
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Microsurvey: Systematica £1200
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Mu Simp/Mu Math: Microsoft £14
Performs sophisticated mathematical functions whilst keeping track of all 611 digits.
SNAP-Survey Analysis: Mercator £65
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4. BASIC

TCL DISK BASIC: TCL Software £5
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CBasic II: Software Systems £7
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CB80: Compiler Systems £31
Compiler for CBasic. Improves Cbasic programs 5 to 10 fold in terms of speed and ability.
Basic 80: Microsoft £17
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Basic Compiler: Microsoft £20
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Xbasic: Xitan Systems £19
A new BASIC with many attractive features: mathematical accuracy, graphics routines for Hi-tech SID1 colour card.

5. PASCAL

TCL Pascal CP/M: TCL Software £12
This is a powerful, general purpose language suited both to beginners and experienced users. Ideal teaching tool.
TCL Pascal Pet: TCL Software £12
Specially designed for Commodore UK. Versions for 3032 4032 and 8032 Pets.

6. OTHER LANGUAGES

C-Compiler: BD Software £7
This is a powerful, fast, compact, modular implementation and subset of Unix C.
C-Compiler: Whitesmiths £47
The ultimate in system software tools. Compiler output in A-Natural source. Supplied with A-Natural.
C/80: Software Toolworks £5
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CIS Cobol: Microfocus £42
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isp 80: Software Toolworks £42
isp interpreter, offers over 75 built in functions including ace, file I/O and string operations.
lu-Lisp: £119
licrocomputer implementation of Lisp programming nguage suitable for artificial intelligence applications.

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dit 80: Microsoft £69
ery fast random access text editor. An ideal product to se as a programming tool.
ex: Digital Research £55
ext formatter to create paginated, page numbered and stified copy from source text files.
Wordmaster: Micropro £75
Comprehensive screen based text editor for programmers. Has superset of CP/M's ED commands, also similar to Wordstar.

8. APPLICATION TOOLS

Pearl III: £295
Produces application programs by allowing user to "converse" with the computer. Early program generator.
Qsort: Structured Systems £89
Fast sort/merge for files with fixed record length.
Supersort: Micropro £125
Best commercial sort for fixed & variable length records merges data from several files, multiple keys etc.

9. OPERATING SYSTEMS

CP/M 2.2 Tuscan Version: Digital Research £95
A version of this general-purpose operating system available fully configured for Tuscan users.

10. COMMUNICATIONS

Bisync-80: £445
Synchronous communications with any CPU or device that provides IBM support. Error checking.
BSTMS: £125
Intelligent terminal program for CP/M systems. Emulates a TTY when hooked up to a host computer.
BSTAM: £125
Utility that permits two CP/M micros to communicate by RS232 or modem and telephone line.
TTY: Systematica £180
A synchronous communication to other computers. Micro is an intelligent terminal, plus ability to download files.

11. DEVELOPMENT AND UTILITY PROGRAMS

Archive: de Gale £100
Compresses files to less than half size for compact disk storage.
Compress: Mike Lewis £29
A package to compress Microsoft Basic 80 code. Makes it more compact on disk and reduces run-time.
Crash Patch: Elektrokonsult £70
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UVMAC-Z80: Software Toolworks £40
Absolute macro Assembler for Z80.
Text: Software Toolworks £40
Takes the output from a cheap editor and gives it the appearance of having passed through an expensive word processor.
Despool: £50
A utility program to permit simultaneous printing from text files while executing other programs.
Diagnostics II: Supersoft £65
Utility for disk testing. Routines to check the VDU, printer, disk drives CPU and memory.
Disilog: £55
Disk based disassembler.
Disk Doctor: Supersoft £65
A popular utility for disk repair.
DDump: Elektrokonsult £35
Dumps file and then reviews by track, sector or block. Possibly the best ever disk editing routine.
Dtest: Elektrokonsult £35
Tests and locks out corrupt areas on disk.
Macro 80: Microsoft £110
8080/Z80 Macro Assembler, Relocatable, linkable output.
Forms II: Microfocus £100
IBM/CPM: £135
Allows the transfer of data between IBM and CP/M systems.
Lynx: Avtek £250
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Mac: Digital Research £73
8080 Macro assembler, with full Intel macro definitions.
RMAC: Digital Research £120
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Ratfor: £42.50
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Reformatter: £140
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Reclaim: £50
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Restore, Spool, Unspool, Qsub: FBN Software £45
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Smartkey: FBN Software £45
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Smartprint: FBN Software £45
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Supervyz: Epic Software £65
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Sid: Digital Research £55
8080 Symbolic Instruction Debugger which expands upon the features of the CP/M standard debugger.
Zsid: Digital Research £65
Symbolic debugger for Z80 instructions, with Z80 mnemonics.
Z80 Development Package: SD Systems £55
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12. MISCELLANEOUS SOFTWARE

CP/M User Group:
A range of public domain software, available from TCL Software for disk and copy charge.
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Set of programs and a book to perform school timetabling.
Typing Tutor: TCL Software £35
Interactive tutor which uses the calculating power of the computer to assess and set exercises.
Authoring: TCL Software £30
A small package designed to help non-programmers to write computer-aided programs.
Estate Agents: Mike Lewis Consultants £800
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XSM 8048 £130
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Ada: RR Software £350
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Ada: Supersoft £185
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Keele Codes (E40): Keele Codes Ltd £100
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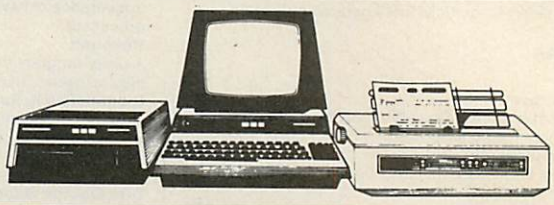

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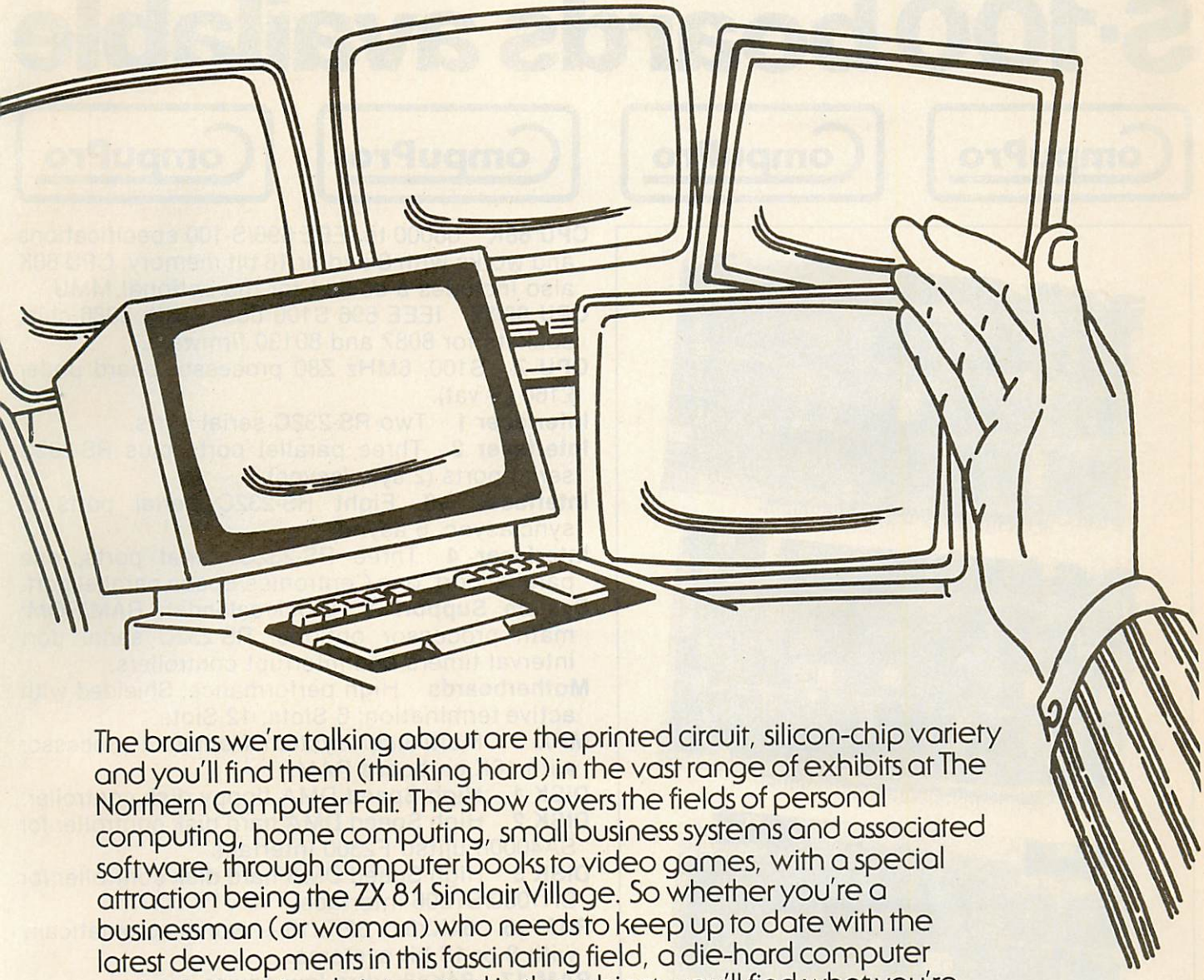

The brains we're talking about are the printed circuit, silicon-chip variety and you'll find them (thinking hard) in the vast range of exhibits at The Northern Computer Fair. The show covers the fields of personal computing, home computing, small business systems and associated software, through computer books to video games, with a special attraction being the ZX 81 Sinclair Village. So whether you're a businessman (or woman) who needs to keep up to date with the latest developments in this fascinating field, a die-hard computer enthusiast, or simply interested in the subject, you'll find what you're looking for at the Northern Computer Fair.

Ticket prices at the door are £2.00 for adults and £1.00 for children under 16, but special party rates are available for 20 people or more with the organiser admitted free. For more information contact IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Tel: 01-643 8040.

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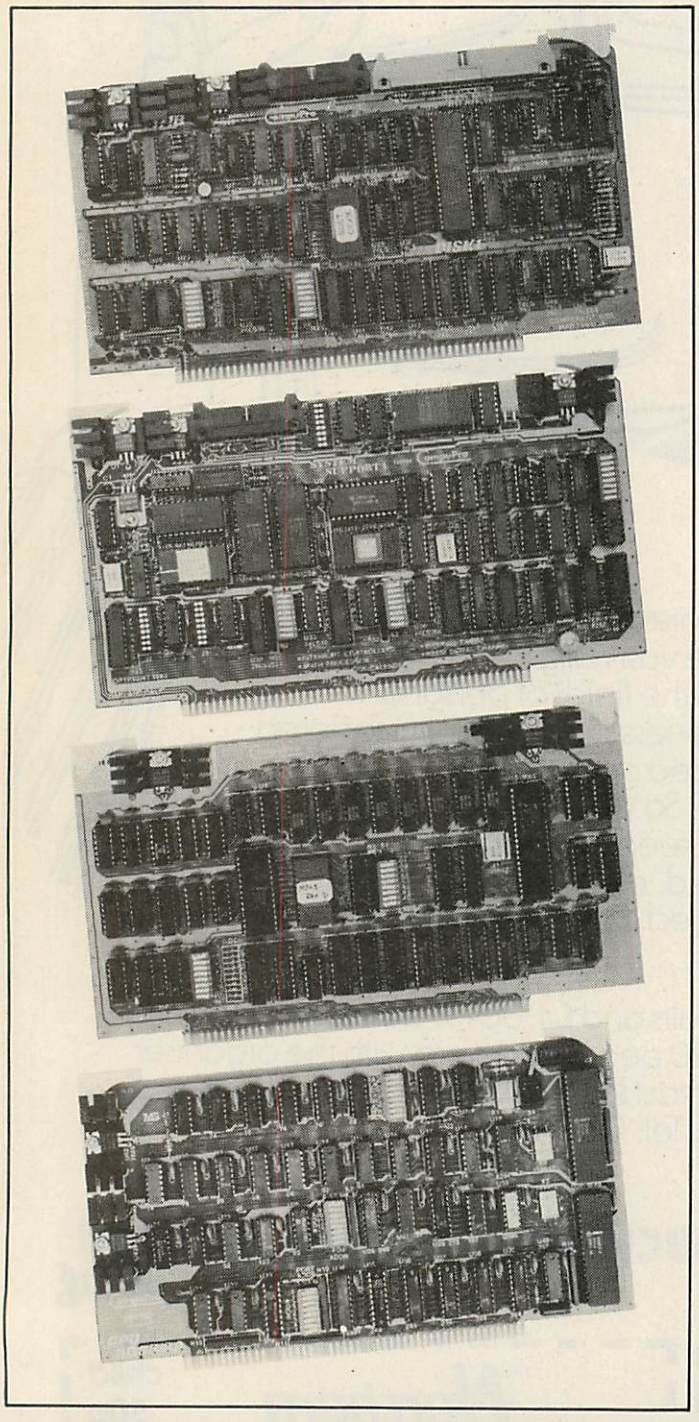

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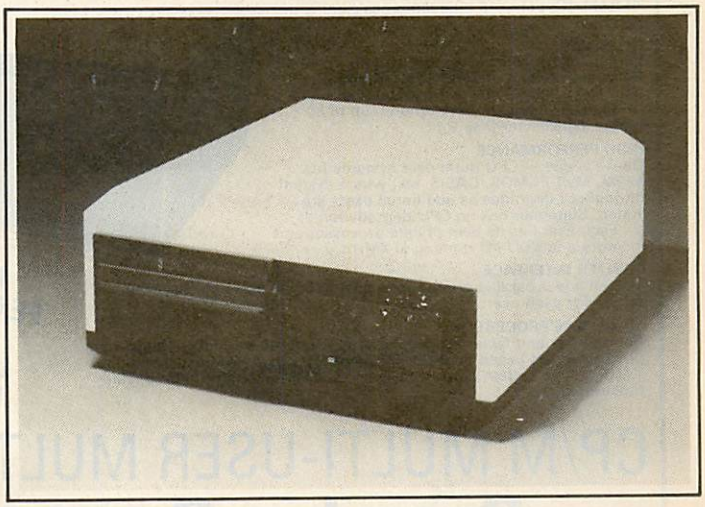

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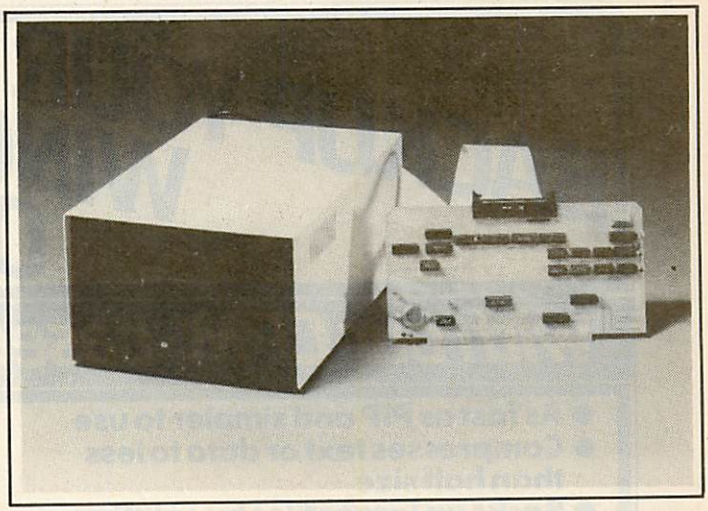

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The HX-20 is a real computer, not a gimmicky toy. Or an extension of your calculator. Or just another desk top computer. It is a precision machine with 16k RAM which is optionally expandable to 32k and 32k ROM expandable to 64k, RS-232C and serial interfaces.

The full size ASCII typewriter keyboard and five programmable keys brings ten

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The HX-20 is light and totally portable for writing programs and manipulating data – virtually anywhere. (Just four nickel-cadmium batteries and a low power all-CMOS memory gives you a reliable power source during your travels.)

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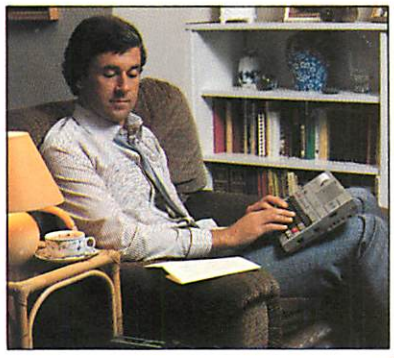

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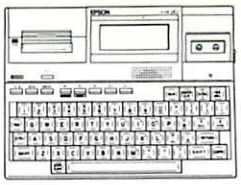
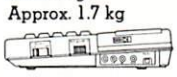
Specifications of HX-20

Dimensions and Ambient Conditions



Dimensions and Weight

1. Dimensions:	290mm wide 215.5mm deep 44mm high
2. Weight:	Approx. 1.7 kg



Ambient Conditions

1. Temperature:	5°C to 35°C (operating) 5°C to 35°C (charging) –5°C to 40°C (data storage) (RAM battery backup) –20°C to 60°C (non-operating)
2. Relative humidity:	10% to 80% (operating, no condensation) 10% to 80% (non-operating, no condensation)
3. Shock resistance:	1 G for 1 ms maximum (operating)
4. Vibration resistance:	0.25G 55 Hz maximum (operating)

Power Supply (Nicd batteries)

1. Voltage:	4.5V to 6.0V (operating) 4.0V to 6.0V (data storage) 4.5V (low voltage detection)
2. Battery capacity:	Approx. 1100 mAH

AC Adaptor

1. Input voltage:	AC 220V/240V ± 10%
2. Power consumption:	8W
3. Insulation resistance:	10megohms between AC power supply and case
4. Insulation strength:	Can withstand 1 kV applied between AC power supply and case for 1 minute or more

Microprinter (M-160)

1. Printing system:	Dot impact (4 printing solenoids)
2. Printing format	
a. Total number of dots:	144 dots maximum/dot line
b. Number of characters per line:	24 maximum (5 x 7 dots; character-to-character space 1 dot) (6 characters/printing solenoid)
3. Printing speed	
a. 1 dot line:	Approx. 150 ms (continuous printing)
b. 5 x 7 dot matrix (interline space 3 dots):	Approx. 0.7 line/s (continuous printing) 42 lines per minute
4. Character size	
a. Dot spacing:	0.33mm horizontal 0.33mm vertical
b. 5 x 7 dot matrix:	1.7mm wide, 2.4mm high
5. Recording paper	
a. Kind:	Plain paper
b. Paper width:	57.5 ± 0.5mm
c. Outside diameter:	50mm or less
d. Thickness:	0.07mm
e. Weight:	52.3 g/m² (45 kg/1000 sheets/1091 sheets x 788mm)
6. Paper feed:	Automatic feed every dot line; with paper release
7. Inking	
Ribbon cartridge type	
Automatic continuous feed during motor operation	
a. Colour:	Purple/Black
b. Dimensions:	Approx. 91mm wide, 25mm deep, 7mm high
c. Life:	Approx. 10,000 lines
d. Standard:	ERC-09

Liquid Crystal Display

1. Text:	Upper and lower case, numerals, symbols, graphic characters and more; 20 characters per line; 4 lines in total (20 x 4 = 80 characters)
2. Graphic:	120 dots (horizontal) x 32 dots (vertical) = 3840 dots
3. View angle adjustment:	Adjustable with VIEW ANGLE density control

Keyboard

1. Key switches:	Typewriter layout, full size. 68 keys (including 5 function keys and 13 special keys)
2. Others:	Power on switch, VIEW ANGLE density control for LCD, and adjusting circuit built in

RS-232C Interface

1. Connector:	DIN (8-pin) TCS 4480
2. Input and output levels:	RS-232C standard
3. Transfer speed:	110, 150, 300, 600, 1200, 2400, 4800 bps (selectable by operator)

Serial Interface

1. Connector:	DIN (5-pin) TCS 4450
2. Input and output levels:	RS-232C standard
3. Transfer speed:	38, 150, 400, 600, 4800 bps (selectable by operator).

HX-20
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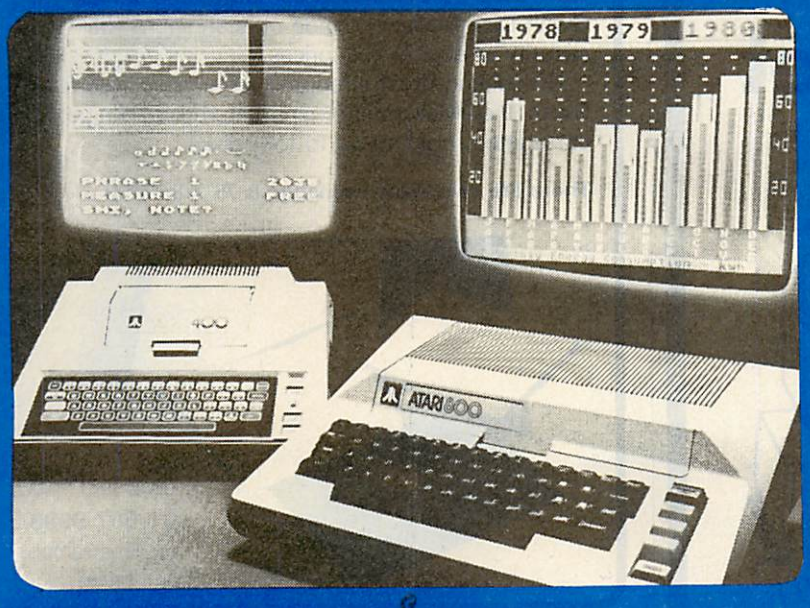

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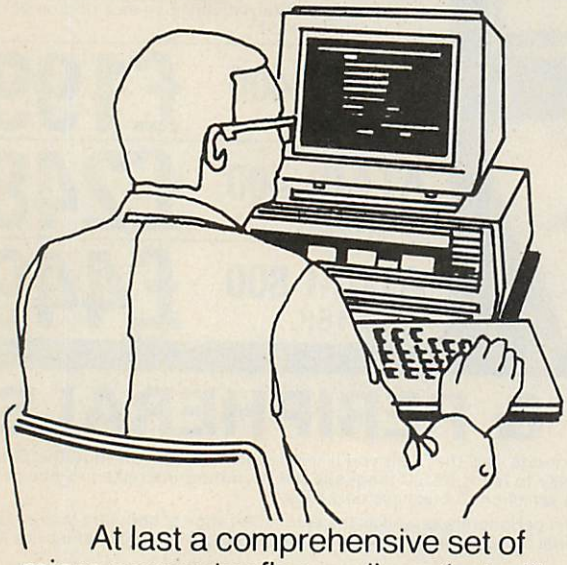

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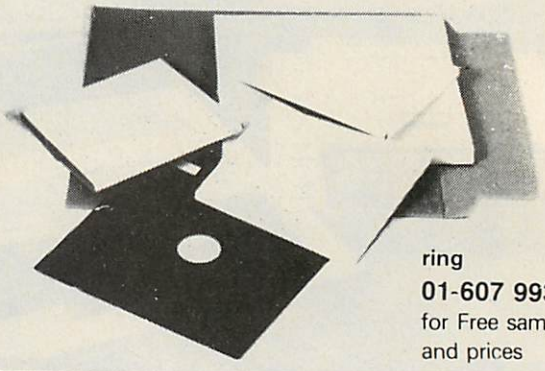

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Each month Practical Computing examines personal computers, peripherals and software packages, providing unbiased critical comment on the strengths and weaknesses of the products reviewed.
This, together with descriptions of programming techniques, and the Open File Section which contains hints and items for users of Apple, Pet, Tandy, BBC and Sinclair Computers, makes Practical Computing an invaluable source of information and advice.
So if you've missed a particular issue make sure that you're not missing out on information which could be of real value to you. Just check through the Contents of our Back issues, then fill in and return the coupon below.

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Reviews: BBC micro; Vic 20 v Atom; Softy – 2; Database Software. Transforming a Pet into a terminal; DNA modelling – the Biological Evolution Game; Controlling an audio-visual show with a Pet.

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Reviews: Osborne 1; Alphatronic; Arfon speech board. Furture of CP/M; Education – Speed reading program; Tandy in a West Country School. Grand Prix – Formula One racing analysis.

March 1982
Reviews: Sirius; Kontron; Ricoh printers; Sales Ledger package. Apple software; Adventure – history of the game and its offshoots; Patsy – how to asses your skill as a programmer.

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Reviews: North Star Advantage; Percom; Hard-disc Superbrain; MBasic. Education – Schools' Software; Testing language ability. Stock control on a micro; Income tax assessment; CP/M explained.

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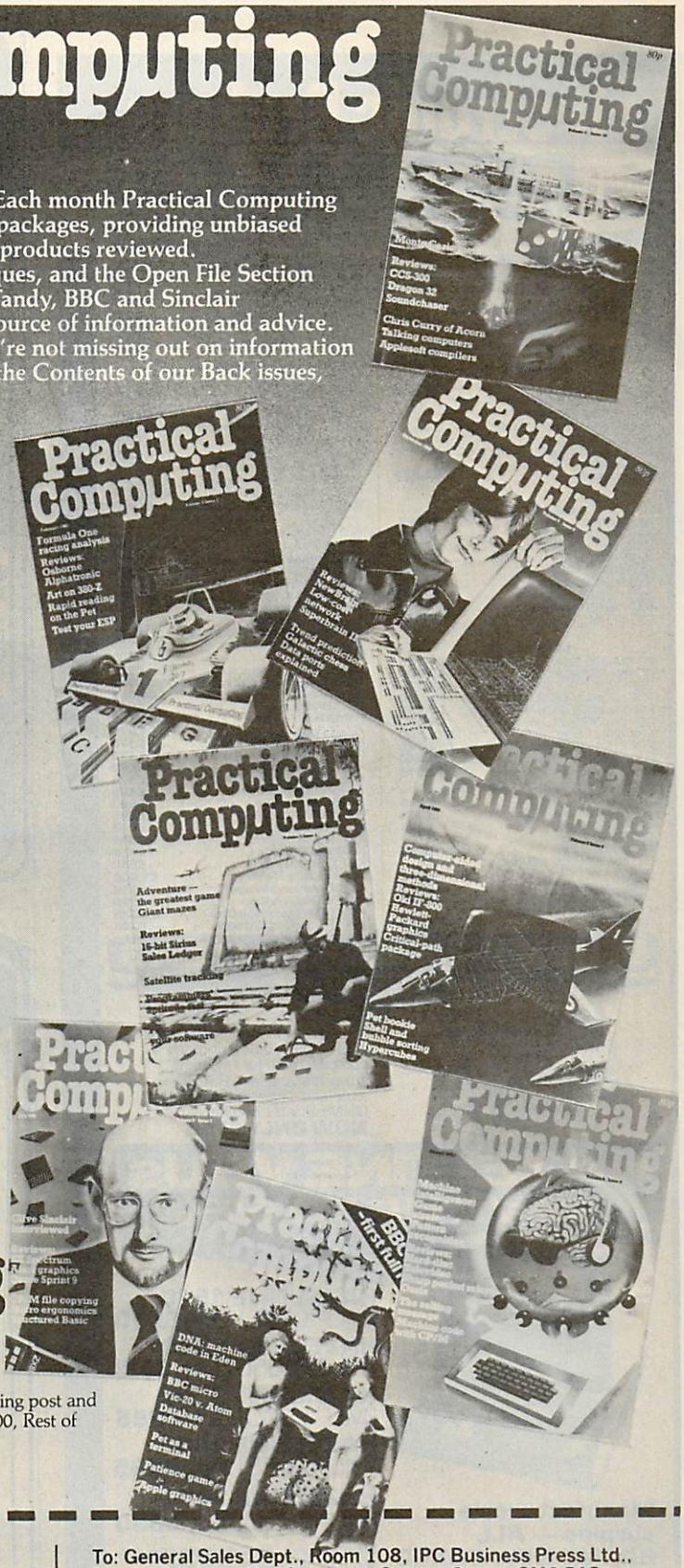

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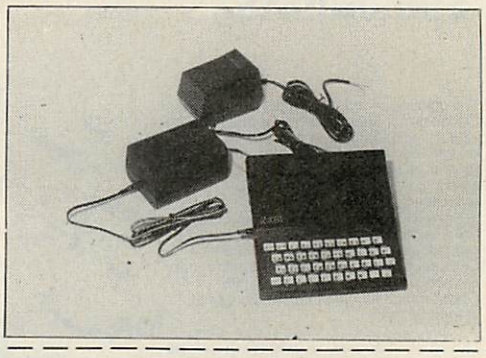

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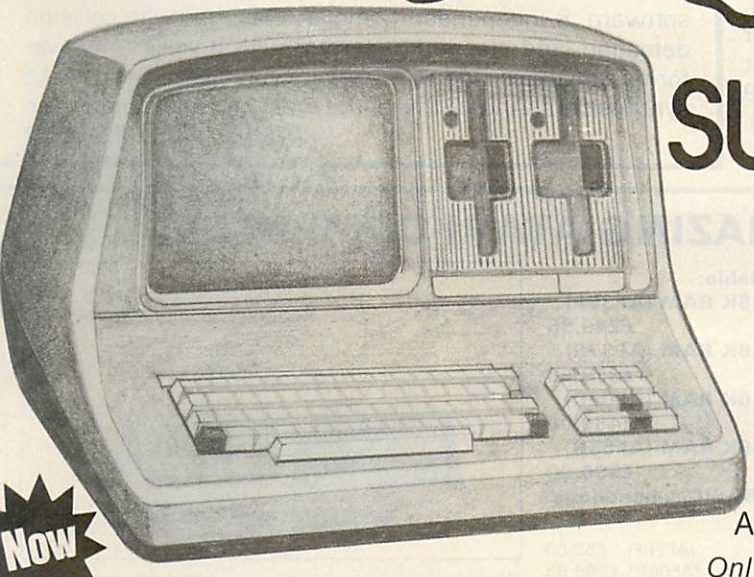

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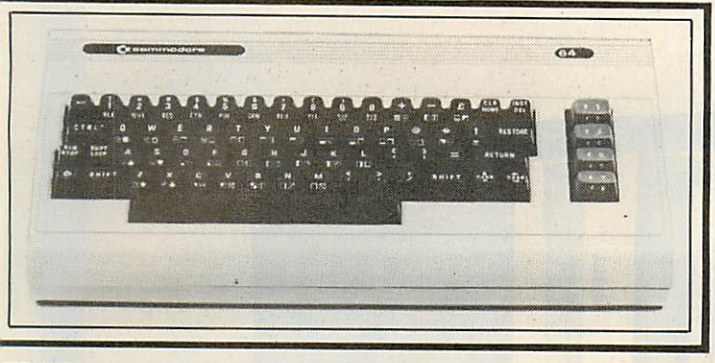

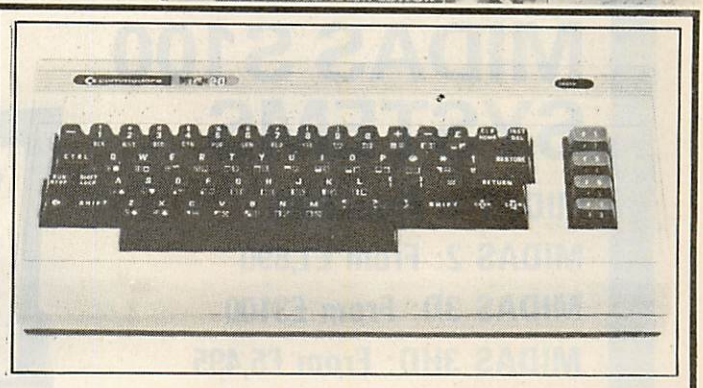

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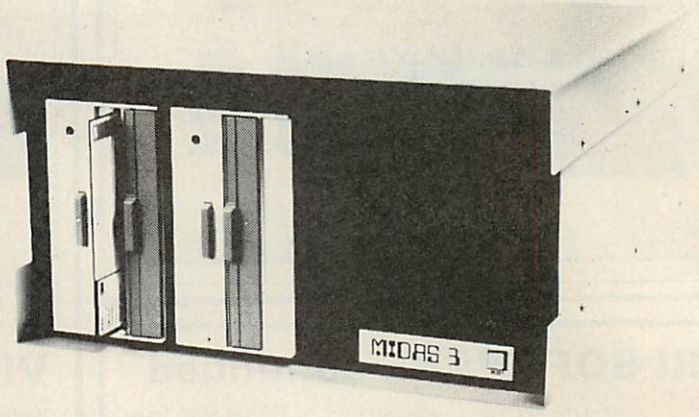

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Protection from pirates

WE OFTEN RECEIVE unsolicited software for possible review, and normally we are very pleased about that. However, three of the last four Apple programs we have been sent have failed to boot, no matter what tricks we have tried. This is carrying software protection a little too far.

Nowadays most professional programs are protected against copying, but unfortunately this makes them less useful to the buyer. First, there is the inevitable problem of discs being corrupted or otherwise destroyed. Without a back-up copy to hand, the result is at the very least infuriating. It could lead to company paralysis and financial loss. Second, there is the question of suitability for use. The fact is that not all off-the-shelf programs are ideally suited to one person's particular needs, even though they may do a reasonably good job for a reasonable number of people. It helps the user if he is able to get inside the program and change it around a bit to modify the screen display or change a few routines to customise a program for a particular use. Copy-protection routines make both these approaches that much more difficult.

Thus software protection aimed at pirates ends up being to the disadvantage of end-users. Meanwhile — and this is the irony of the situation — the real pirates still find ways to steal the programs.

It is not difficult to see the problem from the software writer's point of view. All he really wants is to be properly rewarded for his time and talents. A program copied, he reasons, is a copy not sold. Therefore protecting a program will lead to increased sales and more money for him.

Alas the situation is not quite as straightforward as that. Two main things actually govern the number of copies of a program that can be sold, given equal marketing: the quality of the program and the price. Moreover, all the evidence suggests that price is the more significant of the two. Selling them cheap works, even without piling them high first.

The software writer/publisher therefore has a choice. He can try and sell, say, 100 copies of his program at £500 each, or 1,000 at £50, or even 10,000 at £5, but in each case he makes — for the sake of argument — the £50,000 he deserves. The point is that 200 copies of a program do not actually cost significantly more to produce than 100 — after all, that is what makes copying so attractive to pirates. The real deciding factors in pricing a program are therefore the size of the potential market and the cost of supporting it.

Some programs will have an inherently larger market than others. To give an obvious example, the potential sales of a whisky-blending program written for the DAI micro will be rather smaller than those of a Space Invaders program for the ZX-81 — though in the latter case, the competition will be tougher. The pricing must therefore reflect the potential market. Some programs will require inherently more support than others. A tax program — to give another obvious example — will require frequent revisions as the tax laws change, whereas a games program will, generally, not. Again this must be reflected in the price.

Obviously someone who pays £500 for a program will expect updates and support, even if it is just advice over the phone. Someone who pays £5 for a program will generally be satisfied if it works more or less as advertised, and will ask no more. But in these two cases, just what function does software protection perform?

The user who pays £500 or even £5,000 for a program is clearly a businessman rather than a pirate. No businessman with any sense is going to rely on a pirated program that deprives him of software support and updates. Remember he is buying a facility and a service as much as a piece of code.

The user who pays £5 for a program is likely to be a home user, not a pirate. He will still want a reliable program with some sort of guarantee, and he will probably want the packaging and instructions. He is not very likely to buy a pirated program — at least knowingly — because with a cheap program it is simply not worth it.

Thus the piracy problem arises in two areas. First, there are thieves — the swash-buckling overtones are not appropriate — who mass-produce programs and sell them as though they had the right. Second, there are the people who copy the odd program from a friend or whatever, because to them the program is simply not worth the asking price.

The real thieves are unlikely to be stopped by copy-protection routines. They must be dealt with by the law. It is regrettable that as with video piracy the law is weak, and it ought to be strengthened to protect software authors and publishers as well as it protects book authors and publishers. Some recent victories by Atari in the United States offer some hope in this direction, but in the U.K. a strong case could be made for immediate Parliamentary action.

People who make the odd copy of a program for a friend are doing wrong, but probably cannot be stopped. They are used to taping songs from the radio, or videotaping films from TV. They photostat book pages and magazine articles. They occasionally reach such heights of criminality as to read a copy of *Practical Computing* they have not purchased. In each case, the author is deprived of rightful payment.

Software protection can discourage such casual copying, but cannot prevent it. Too many users are now far too sophisticated, even without the help of programs which exist only to copy programs. The only long-term solution for the software writer is to offer better programs, better documentation and better value for money. After all, people still buy millions of magazines, books and records when they are good quality and good value. They will buy good software too.

Of course it is still possible that someone will perfect a form of software protection, but is it likely? In days of old, knights were bold until advances in the art of archery rendered their particular form of software protection — suits of armour — useless. They had to shed their cumbersome heavy-metal cladding and become much faster on their hooves in order to compete. Here comes the cavalry! Nowadays we unthinkingly accept expenditure on intercontinental ballistic missiles as part of the "defence" budget because we know that, ultimately, there is no defence except the readiness to attack.

The time for software authors and publishers to attack is now. But could they please do it by enhancing their products, and by lobbying the government, not by making life even more difficult for the users.

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Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

Superbrain connection

THANK YOU for your Superbrain review in the September issue. Certainly, Superbrain is a well-established product in a market environment which requires continual technological change. Our engineers are fully committed to keeping us in the forefront of technology and I will be pleased to provide you with further details as soon as they are available for publication.

I note Mr Stobie's comments concerning the fact that the 10Mbyte hard disc cannot be connected to the Superbrain and I would appreciate it if you could clarify the position. The 10Mbyte Disc-Storage System can be connected to the Superbrain II by a simple connection cable, which we supply. The 10Mbyte DSS is available from our dealers for approximately £2,400.

Robin L Harrison,
Intertec Data Systems,
Columbia,
South Carolina.

Small firms rebuffed

HOW RIGHT your September editorial is!

My wife and I had the good fortune to win an Apple in the launch competition of this magazine and some of our work has been described in it. We have repeatedly sought help for substantial further developments in applications for handicapped people — from the Department of Health and Social Security, Department of Education and Science and the Department of Industry. Having recently reached 15 refusals I was getting jaundiced until I met someone with excellent credentials who has clocked 30. Can anyone better this?

In dealing with applications the one thing that doesn't seem to matter at all is the professional quality of the proposal and the managerial experience of the organiser. I have never been asked to supply copies of programs or other work, never had a professional reference sought, never been asked for a demonstration or for any of the other things that would show serious concern.

The fact is that the Government prefers to drop £10 million on a flashy gimmick rather than help the small firm. That's a pity, as now "the big boys", Canon and Texas Instruments, are moving into the electronic aids field. A dozen of us warned the DHSS about this two years ago. The letter was ignored.

The DoI, to its credit, is at least courteous to applicants. Ken Baker, however, should ask how many of the 200 firms that have grown up around Sinclair have had any help from his department. When he has the answer he might consider widening his range of advice to include those who really know how to make a little money go a long way.

J R Seagrave,
Happy Apple Software,
Ruislip,
Middlesex.

● According to NCC Director David Fairburn help cometh — see the October issue editorial.

Spectrum compared

I WOULD LIKE to reply to a letter that appeared in Feedback in the October issue of *Practical Computing*. One of your readers writes "in Spectrum's Defence" that it was as quick overall as the Tuscan, 63 percent as quick as the Vic-20 and 85 percent as quick as the UK 101.

We have recently been comparing our eight-bit system timings, running standard benchmark programs, with those of some recently announced pseudo 16-bit machines. It came as a bit of a shock therefore to see our computer put equal with a Spectrum.

It does appear that your reader was comparing his Spectrum with a Tuscan running resident Basic with a 2MHz CPU which we no longer use. All our production systems have had 4MHz Z-80As for over 12 months now and in fact we now have a version using the Z-80B running at 6MHz. Although our sales of machines are now predominantly CP/M disc-based we have always prided ourselves on having a fast machine.

I list the results and would point out that the benchmarks were run using Microsoft Basic on all machines. I think you will agree that the current pseudo 16-bit machines do not offer any advantage in terms of throughput, at least when using Basic. A lot of current application software is written in Basic and so it is also interesting to conjecture how much slower the pseudo 16-bit machines would be when running such software originally written to run on eight-bit micros. Perhaps some readers would oblige here.

We appreciate that speed is not all one is looking for from a micro but in most serious applications it is a major factor. I feel that more could be done to compare like with like in this area.

Brendan Owen,
Transam Microsystems Ltd,
London WC1.

Teachers reply

A RECENT spate of articles in the computer press has a common theme — teachers are rotten programmers. Teachers would seem to be passing on poor programming habits because they know of no alternative. University lecturers, in particular, have the problem of overcoming these misconceptions with their new undergraduates.

I would not dare argue that all teachers are experts in structured programming but I suspect there is more than just a small minority who understand the arguments and who are quite competent practitioners. As with much else in schools' computing many of the problems

(continued on page 43)

Spectrum compared.

Benchmarks in seconds

Computer	1	2	3	4	5	6	7	8
Sirius — 5MHz 8088	2.0	7.4	17.0	17.5	19.8	35.4	55.9	42.5
IBM — 8088, 4.8MHz	1.4	5.2	12.1	12.6	13.6	23.5	37.4	3.5
HP-86	3.0	5.2	19.4	18.8	20.4	36.5	5.5	13.4
Olivetti M-20 — Z-8001, 4MHz	1.3	4.0	8.1	8.5	9.6	17.4	26.7	1.6
Tuscan S-100 — Z-80A, 4MHz	1.1	3.9	10.6	10.6	11.3	20.0	31.8	5.3
Tuscan S-100 — Z-80B, 6MHz	0.8	2.5	6.4	6.7	7.2	11.4	18.4	3.6
Sinclair Spectrum	4.8	8.7	21.1	20.4	24.0	55.3	80.7	25.3

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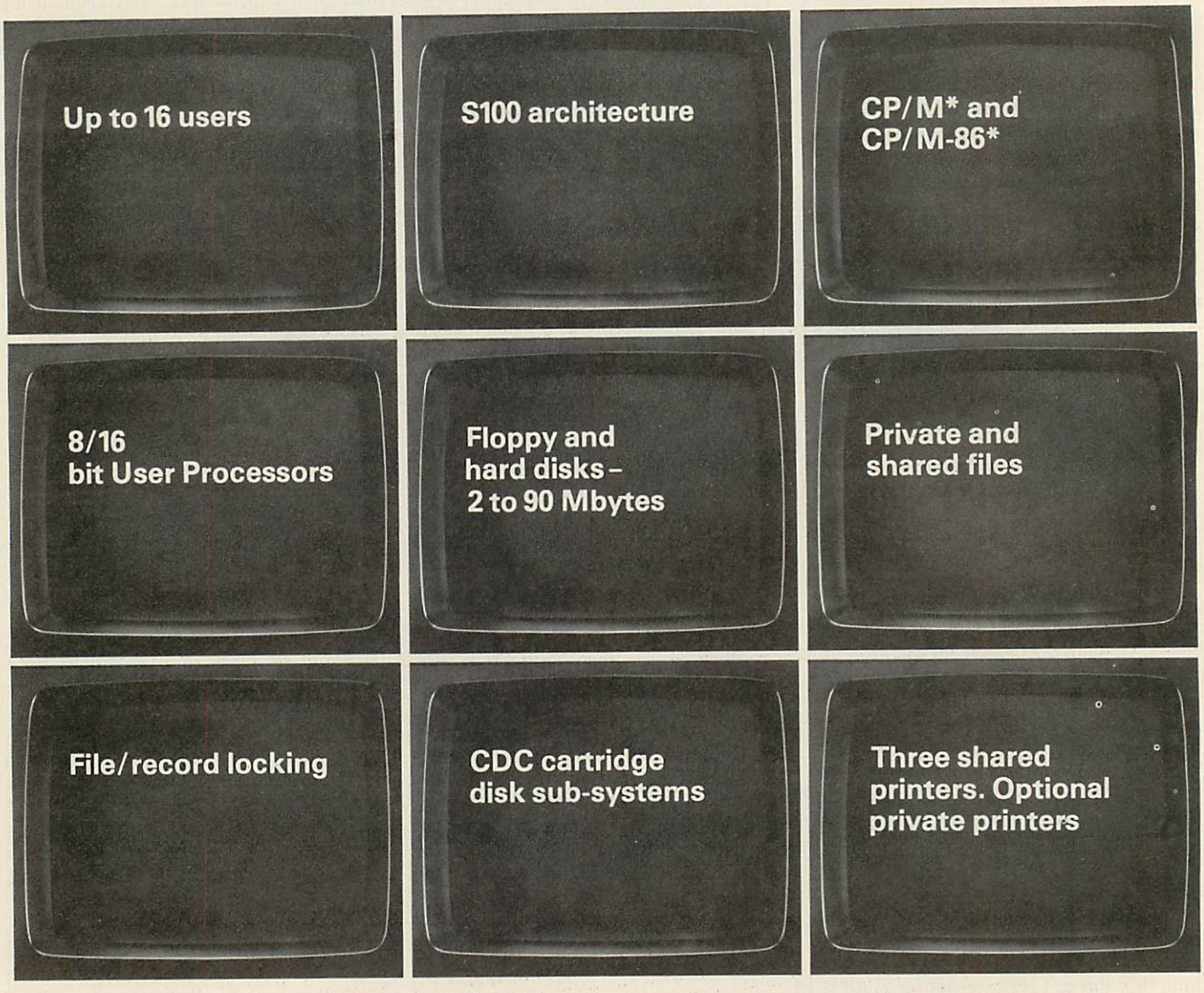
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Newtons Laboratories, PO Box 789, 111-113 Wandsworth High Street, London SW18 4JB. Tel: 01-874 6511. Telex: 21768 (Newton G).

(continued from page 41)
in teaching programming can be traced to insufficient and obsolescent resources — how can you teach good structure when the majority of schools still have a dialect of Basic that groans as soon it sees an If-Then-Else? Why hasn't the Government asked the leading suppliers of micros in the Department of Industry scheme to implement a full and common structured Basic as the price of its continued sponsorship?

Critics, please keep in mind what schools' computing is all about. An average school of 1,000 students would be lucky to have £400 a year to spend on the subject which is hardly enough to purchase the latest software let alone hardware. Moreover in that same school, with perhaps 150 students taking computing courses leading to an external examination, perhaps only 10 will be on an A-level course. If some of these university critics are so unhappy then why not follow the lead of Dr Wilson of Manchester University who provided Pascal free to schools via Muse. That is practical help.

Terry Brown,
Wyggeston Collegiate,
Leicester.

No bugs on me

MAY I BE allowed the right of reply to the two characters who in Feedback, June issue, see fit to pull my program Patsy to pieces. The program itself appeared in *Practical Computing,* March 1982. There were no errors in the program as published. It was listed from a fully tested and working version. Of course, if people will not type in programs exactly as listed they should not expect them to work. Mr Swann clearly could not be bothered to type in lines 1 to 10 containing the program name, my copyright message and what was intended to be a helpful Rem. If he cares to read my piece "Data Separation" in Tandy Forum, *Practical Computing* June, he will perhaps see where he went wrong.

Then we have Mr Robinson, who may be simple but is certainly not elegant. He is typical of candidates I have tested and failed with Patsy for oversimplifying the complexity of the problems set. Evidently Mr Robinson has not bothered to type any of the program in or he would have discovered that only in two of the 10 problems are buttons 4, 5 and 6 all capable of working simultaneously in the same time period. In neither of these cases do any of his combinations lead to a solution. He fails to appreciate that time is a dimension of this quite sophisticated testing method.

Michael Smith,
Camborne Beacon,
Cornwall.

Atom on the boil

MY ACORN ATOM becomes excessively hot very quickly, and this then affects the behaviour of the computer: pressing Break has no effect apart from printing up random characters, and apart from the Break all other keys become inactive. The only thing then left to do is to pull out the plug and let the system cool, losing the program in the process.

Whenever there is a Wait statement, after a few Runs the computer seems to give an obscure error, not detailed in the manual or the error card, and after a while the computer goes dead. Once again the keyboard has no effect.

I have contacted Acorn Computers a number of times but to no avail. Could anyone please advise me on what to do?

P Sharma,
Maidenhead,
Berkshire.

Monte Carlo corrections

I WAS PLEASED to see my article on Monte Carlo methods in the October issue of *Practical Computing.* However a few mistakes crept into the article which I would like to clarify.

- The box shown in figure 2b should give a better estimate of I than the box shown in figure 2a for the same value of N.
- Always be sure not to move P, that is I/box area, nearer the centre of the parabola.
- The figure at the top of page 80 should of course be labelled as figure 3, not figure 1, and P = I/box area, not 1/box area.

Bill Hill,
Manchester

Helpful structures

IT WAS PLEASING to read two articles about structured programming in *Practical Computing,* August 1982. Boris Allan's article "Searching for the truth" seems to challenge the theoretical foundations of structured programming but accepts the usefulness of its practice when it is not concerned with correctness proofs.

There is a great deal of experience and wisdom in the writings of such people as Dahl, Hoare, Dijkstra, etc, whether or not its mathematical basis is valid. It is easy to trace their influence through Pascal to Comal, structured Fortran, BBC Basic, Oasis Basic and so on. One seems to hear of a new structured Basic every other month now.

What seems important for beginners or competent programmers, who would not claim to be computer scientists, are the practical effects of these structures when they are actaully embodied in the syntax of a simple language. These effects are numerous but I would say that the main ones are as follows:

- Clear, easily read programs written in about half the time it would take unstructured Basic.
- Debugging or updating in about one-tenth of the time. This is an approximate measure of the greater initial correctness of structured programs but is has obvious practical benefits.
- The use of only about half-a-dozen program elements which become a common currency and feed back into the user's techniques of analysis and design.

Graham Beech's series emphasises the last point by embodying the concepts in his Program Design Language which has much in common with Comal. His methods are good but if structured programming is to become common parlance among the programming millions it is necessary for as much as possible of Beech's Program Design Language to be incorporated in the simpler languages. Fortunately this seems to be happening on some of the cheaper microcomputers where it can be immensely helpful in the first formative experience of programming.

Roy Atherton,
Head of Bulmershe Computer Education Centre,
Bulmershe College of Higher Education, Reading,
Berkshire.

Outmoded

YOUR EDITORIAL headlined CP/M versus Unix in the October issue poses the question of which operating system will become the next de facto standard. It would be of interest to know how CP/M became the doyen of operating systems when in its early stages it must have had a number of established products with which to contend.

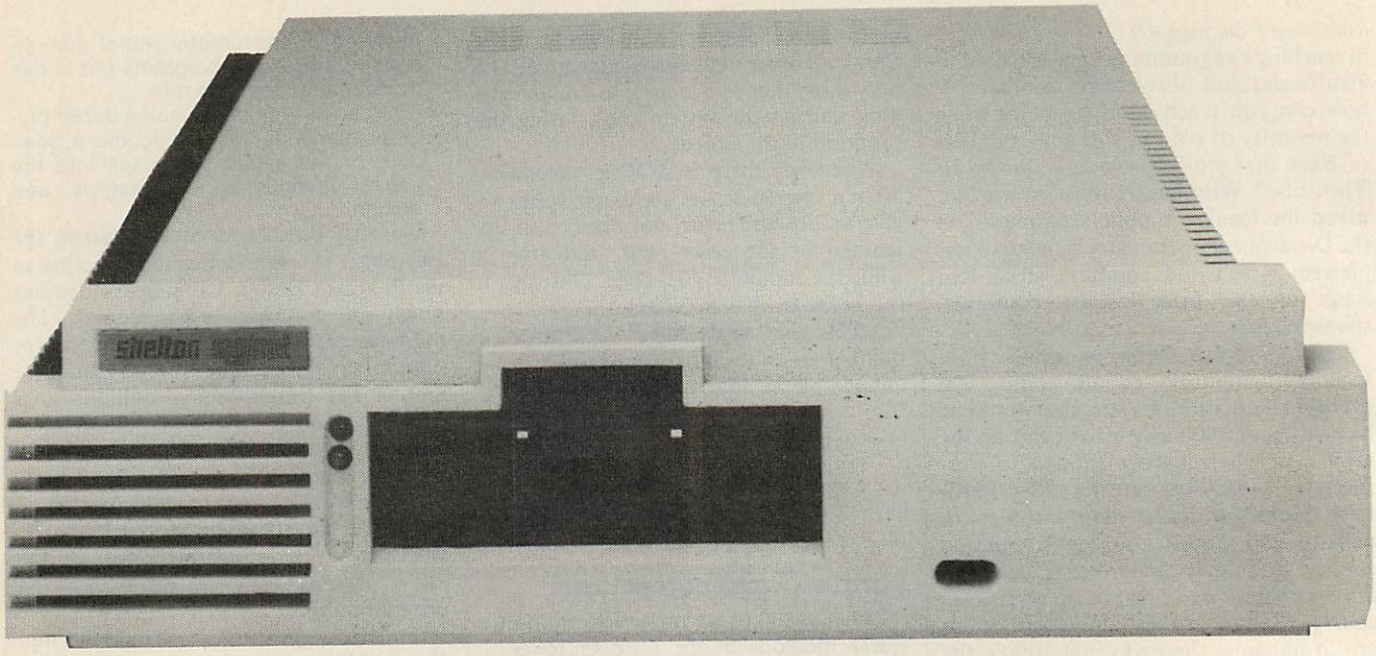
As a home-micro user for the last four years with a system running the TSC 'Flex' operating system, it has been of increasing concern to watch the growth of CP/M knowing that most if not all of one's efforts were likely to be denied any easy transformation to the next generation of systems.

Four years back, when the market for domestic equipment was evaluated,using word processing as the application yardstick for equipment and software selection, there was unquestionably only one demonstrably established system readily available on the U.K. market — SWTPc 6800 and Flex. In this instance however to be first did not lead to becoming established.

Was CP/M really better than Flex? To say that the end-user should not need to be concerned with the operating system associated with his equipment and programs is to over-simplify the potential problems of onward compatibility with next-generation systems.

Regrettably, there is no advice for the first-time buyer which will guarantee freedom from potential conversion costs in future years. This applies not only to the question of 'which operating system' but also to 'which language' as a result of

(continued on page 45)



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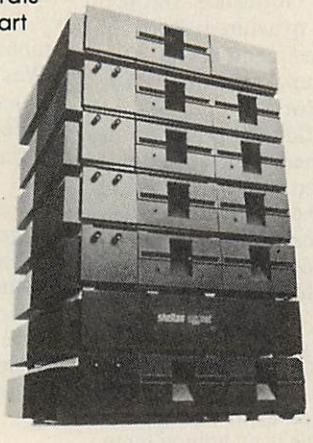

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(continued from page 43)

the proliferation of programming languages and their various dialects. The message is — user beware.

D D McIntyre,
Troon,
Ayrshire.

True or false

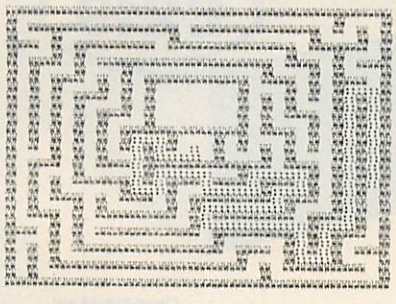
IT IS UNFAIR of you to combine into a single letter published in Feedback October, correspondents whose viewpoints are so incompatible as those of Carl Zetie of Maidenhead and Carl Zetie of Maidenhead. For instance one of them talks of "deriving truth value by reference to reality" and thus proven correct. The other makes it clear that the sin of scientific induction "has been thoroughly discredited by Karl Popper." These opposing viewpoints are not easy to reconcile.

Again Mr Carl Zetie of Maidenhead says that "mathematical induction, on the other hand, is a thoroughly valid method of mathematical proof", whereas Mr Carl Zetie of Maidenhead states categorically that "decuction from axioms is the only kind of mathematical proof" — a view thoroughly discredited by Kurt Gödel.

There is however a third form of mathematical proof, discredited no doubt by Carl Zetie and Karl Popper but acceptable to Euclid, Einstein and myself. This is the *reductio ad absurdum* which proves conclusively that Mr Carl Zetie cannot possibly exist and must therefore by merely a fantasy of the editorial imagination.

Ronald Cohen,
London W11.

Maze modification.



```
1200  IF  SCRN( AA,BB) = 15 THEN
      A$ = A$ + "WW": GOTO 1230
1210  IF  SCRN( AA,BB) = 3 THEN A
      $ = A$ + "::": GOTO 1230
1220 A$ = A$ + "  "
1230  NEXT AA
1240  PRE 1
1245  PRINT  CHR$ (27); CHR$ (65)
      ; CHR$ (6);: REM **** SETS E
      PSON TO HALF VERTICAL LINE S
      PACING
1250  PRINT  CHR$ (15)
1260  PRINT  CHR$ (27)"A" CHR$ (2
      ) CHR$ (27)"2";
1270  PRINT A$;
1280 A$ = ""
1290  NEXT BB
1310  PRINT  CHR$ (27)"A" CHR$ (1
      2) CHR$ (27)"2"
1315  PRINT  CHR$ (18); PRINT  CHR$
      (27); CHR$ (65); CHR$ (12): REM
       RESETS EPSON TO NORMAL WIDT
      H CHARACTERS AND LINE SPACIN
      G
1320  PRE 0
1330  GOTO 1100
1340  TEXT : HOME : VTAB 15: INVERSE
      : PRINT "CHEERS, THEN, FROM
      YOUR FRIENDLY MOUSE.": NORMAL
      : END
```

Maze modification

CONGRATULATIONS to Roy Sayers on his maze-solving article in October's *Practical Computing*. Not all published programs work as well.

It may be that you will be interested in the modifications that I have made to change the printed format. Line 1245 closes up the line spacing, while W for walls and a colon to simulate the mouse's footprints respectively have been substituted in lines 1200 and 1210. Unwanted line feeds in lines 1260 and 1270 have been suppressed by semicolons as shown.

I have also moved the CHR$(18) that cancels condensed printing down to line 1315 from 1300 and added the procedure that resets the line spacing to the same line. My printer is the MX-100 but I think the commands are the same for the MX-80.

The end line shown is another minor change which leaves the Apple in text mode.

Geoffrey Jago,
Nottingham.

Pet printing

HERE IS the answer to the mysterious disappearance and subsequent reappearance of the print line as detailed in J Bartlett's letter, *Practical Computing*, September 1982.

When the Pet receives a Print command the contents of the first stack are automatically shifted into the nearest free buffer in order to accommodate the specified input, in this case a lower-order string variable unjustified. Since the parameters are necessarily defined, anything other than a nil input from the keyboard is implied and it is this which regenerates the reconstruction of the memory-mapped contents. Obviously this does not apply to old-ROM Pets.

Hence, whenever the Pet encounters any previously defined characters, including graphics it tries to reset the program pointer in every instance. The net result is the immediate disappearance from the screen of the character so addressed until the Pet is satisfied that its initial fetch of the character can be verified. Once this happens, the character seems to reappear on the screen in the manner described by your reader.

Touching the space bar slows down the effects because the Pet is still looking for a nil return and it takes correspondingly longer for this loop to complete. The increase in the speed of the effect as a result of varying the number of letters is still under investigation.

Sam Linly,
London W4.

Statistically naive

I AGREED with the general conclusions of your Editorial "Do not overestimate the expert system" in the September issue. However, I am afraid that your passage about classical statistics is quite incorrect.

As a practical statistician working in industry it is not the first time I have met statements like: "If A then 80 percent chance B". Classical statistics might make one think the converse: "If not A then 20 percent chance B".

This is not classical statistics — just a schoolboy howler. It is exactly the same non-logic as: "All the first-division teams are still in the FA Cup. Therefore if you are not a first division team you cannot still be in the Cup."

It is no wonder that, employing this non-logic, the oil-rig manager might reach a silly conclusion about a black view of the night.

M R Brand,
Ingatestone,
Essex.

Maze modification

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Sam Linly,
London W4.

Speedier shuffle

IN THE CARD GAME of Eights used to illustrate your feature about artificial intelligence on page 77 of the August issue, the shuffling routine showed is more complicated than necessary.

As a shuffling routine is needed in many computer card games a more efficient and simpler version is given here. Try to exchange lines 100 and 110 with the following two lines:

```
100 X=0:Y2=6701:GOSUB150:Y2=6801:GOSUB150:
Y2=7201:GOSUB150:Y2=8301:GOSUB150
110 FOR X=51 TO 0 STEP-1:Y5=M(X):Y6=RND(X):
M(X)=M(Y6):M(Y6)=Y5:NEXT
```

Also change MT(X) in line 150 to M(X) and delete line 120. The arrays MT(51) and MM(100) dimensioned in line 20 could be deleted as they are no longer needed.

The routine works by first picking a random card among the 52 cards in the array M(51). This card is then exchanged with card number 52 in M(51). Then a new card is picked among the first 51 in the array and exchanged with M(50). The next card is picked and exchanged with M(49), and so on.

In line 110 the statement

Y6 = RND(X)

should give Y6 a value between 0 and X. If your random function returns a value of between 0 and 0.99999.. the statement should read

Y6 = INT(RND(7)*(X+1))

where 7 is only a dummy parameter.

The card-shuffling routine given here is more than twice as fast and uses only one quarter of the memory space compared to the original routine.

Jorgen Feder,
Rudkobing,
Denmark.

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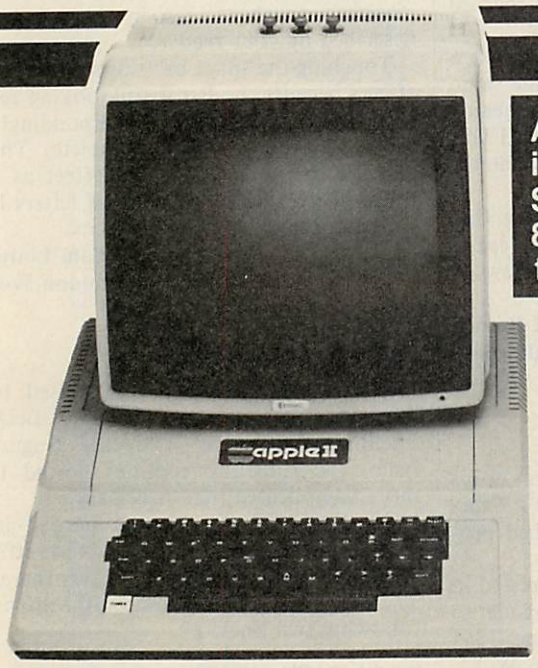

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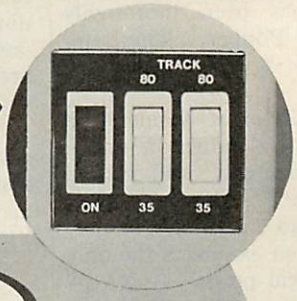

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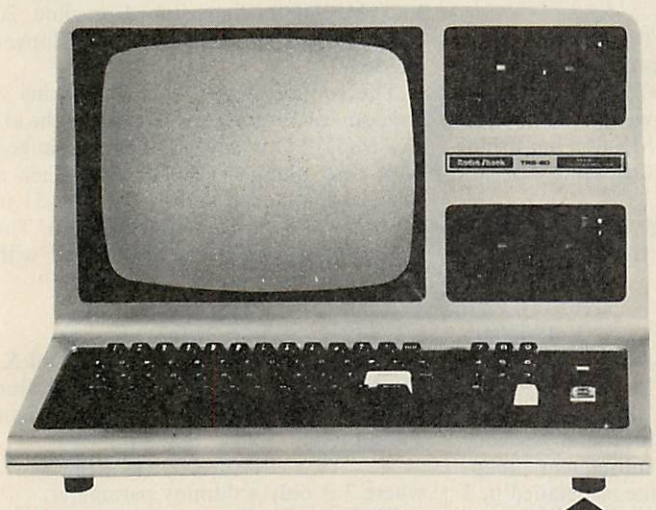

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Manchester fair

READERS living in the Merseyside or Greater Manchester area may be interested in visiting the Northern Computer Fair running from November 25-27. *Practical Computing* is sponsoring the exhibition which is being held at Belle Vue, Manchester.

The show features a Sinclair village packed with stands offering Sinclair software and hardware add-ons. There are also over 50 other exhibitors ranging from Dragon Data to the National Computer Centre. Flight Electronics will be giving the MPF-2, the cheap Taiwanese Apple look-alike, its first U.K. airing.

The Northern Computer Fair is open from 10am to 6pm each day, admission £2 for adults, children £1. Further details from IPC Exhibitions on 01-643 8040.

New disc technology

CONSIDERABLE technical innovation lies behind Sparrow Computer's 10 Mbyte 8in. floppy-disc cartridge system which provides easily-exchangeable mass storage and performance similar to a hard disc. The Bernoulli technology employed may come to challenge the current dominance of Winchester hard-disc systems in the microcomputer sector of the disc market.

The Sparrow 10 works completely differently to a conventional floppy system. The head does not make contact with the recording medium, but instead flies above it on a cushion of air as with a hard-disc system. The mathematical techniques used in the design derive from the work of 18th-century Swiss physicist Daniel Bernouli. In the head region air flowing away from the rapidly spinning flexible Mylar disc makes it behave as if it were a rigid one.

The dynamics of the system make it mechanically easier to maintain a constant head/disc gap than with a true hard disc. What is more, intrusion of dust beneath the head is inherently less likely and when it occurs less dangerous, the disc simply moves away from the head momentarily. As a result very high recording densities are possible because the head can safely fly closer to the recording surface. The Sparrow 10 stores 24,000 bits per inch as against 10,000 for the conventional cheap Winchester. Air filtration is not necessary so the engineering involved in making discs exchangeable is much simpler than that which can be achieved with Winchester technology.

The results for the user are cheaper media, less vulnerability to dust, and quicker exchanging of discs. Cartridges costs about $40 each and take 10 seconds to exchange including the time taken to get up to operating speed again. Access times are similar to those on a hard-disc system.

The Sparrow 10 drive costs around $5,500 one-off with the appropriate controller. Versions are available now in OEM quantities for Apple, CP/M, IBM, Sirius and PDP-11 systems. Direct sales to end-users by OEMs are likely to begin soon.

Contact Sparrow Computer, 45 Ledgers Road, Slough SL1 2RQ. Telephone: Slough (0753) 76533.

With a specification that would have seemed incredible scarcely a year ago, London-based manufacturer MicroAPL Ltd has announced a 16-bit portable APL machine.

Based around the Motorola 6800 chip, the Scorpion uses the S-100 bus, and can accommodate 1 Mbyte of RAM and a 10 Mbytes hard disc inside its 20in. by 8in. by 16in. Osborne-like case. A 5in. floppy can be used in place of the mini-Winchester hard disc.

The 9in. screen gives a full 80-by-24 character display and the lid unhinges to form a full QWERTY keyboard with numeric keypad. The power supply auto-adjusts to 110 or 250 volt AC mains supplies, and a battery-operated calendar clock keeps track of time when the system is not plugged in. An Ethernet interface is provided.

Prices start around £5,950. The system will be at Compec in November and first machines should be available in December.

Contact MicroAPL Ltd, 19 Catherine Place, London SW1E 6DX. Telephone: 01-834 2687/8.

Plug-in card gives Apple 16-bit power

A 16-BIT add-on processor card for the Apple II is available now for £229. It is based around the Intel 8088, and CP/M 86 and MSDOS will be released for it soon.

The ALF AD-8088 Processor Card runs the 8088 at the full 5MHz clock rate using the Apple's 1MHz 6502 principally for I/O. Applesoft programs can be run interpretively without modifications using FTL, a utility provided with the card. FTL sends Applesoft formulas to the 8088 for fast processing. The card also provides the user with a multiple event timer with a resolution of 50 microseconds for scientific applicatons.

Contact Pete and Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JB. Telephone 0706 227011-2-3.

Letter stationery

ASHAMED of your computer? Kleen Edge lets you print on to neat A4-size sheets of paper which do not look like they have come out of a computer printer. The sprocket-holed margins of the continuous paper detach cleanly becaue the perforations are extremely fine.

At £20 per thousand unprinted sheets or £40 with one-colour overprinting the system works out cheaper than carrier-mounted stationery.

Sample from Moore Paragon Business Forms, Moore House, 75-79 Southwark Street, London SE1 0HY. Telephone: 01-928 9022.

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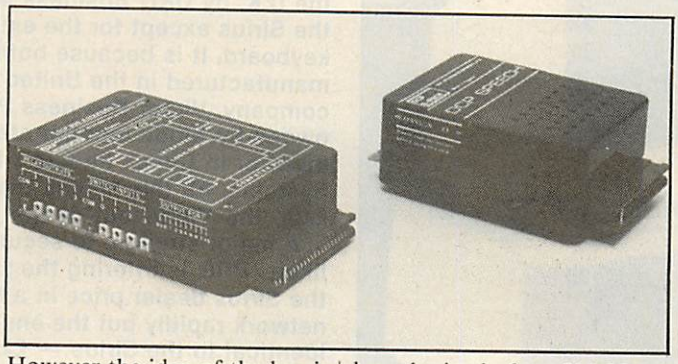
ZX-Spectrum interface

THE DCP INTERSPECT is a total interfacing unit which plugs neatly into the rear socket on the Sinclair Spectrum computer. It provides a wide range of interfaces and on its own rear is the DCP Bus, an expansion system using a 15-way connector, which can control up to four more accessories or, with the addition of just a few components, a total of 255 devices.

Among the interfaces on the main unit are an eight-channel digital to analogue converter, and four relay outputs for controlling high currents. There are also four switch inputs which have been buffered for direct connection to contacts. Digital control is available, with eight bits for input and eight bits for output.

In addition there is the DCP DAC-Pack which can fit on to the DCP Bus. This contains another eight-bit digital to analogue converter with an output range of 0 to 2.55 volts.



However the idea of the bus is that users can develop their own electronics. The necessary software required to control these devices has been helpfully included in the ZX Spectrum in the form of the In and Out commands.

Maybe the most exciting new product from DCP is the Spectrum Speech Pack. It is the same as the previous ZX-81 speech pack from DCP but it adds the power of the spoken word to the computer for a mere £49.95. Additional sets of words contained in ROM can be obtained for £14.95. It comes complete with built in speaker and a volume control. The prices of the Interspect is £39.95 and the DAC-Pack £14.95.

All of the DCP products are supplied fully assembled, tested and guaranteed. They are available from many of the ZX dealers catering for educational users, from Griffen and George Ltd or directly from DCP Products Limited, 2 Station Close, Longwood, Norwich, NR13 4AX. Telephone: Norwich (0603) 712482.

CP/M3 due by New Year

VERSION 3 of CP/M, the dominant eight-bit operating system, should be available from dealers in December. CP/M 3.0, renamed CP/M Plus, is a major revision but it will support applications running on CP/M 2.2 and earlier releases according to authors Digital Research.

CP/M Plus has an improved user interface and the ability to support more internal memory and more discs. A help facility, improved error trapping and plain English error messages are provided. Multiple 64K banks of RAM can be handled. File sizes of up to 32 Mbytes are allowed along with 16 disc drives of up to 512 Mbytes each. End-user price will be £220.

Tandy show

The Leeds TRS-80 users group is holding a show from 9.30am till 4.00pm at Pudsey Civic Centre, Leeds on November 20. For details contact: S Hall, 1 Meadow Valley, Alwoodley, Leeds. Telephone: Leeds 444554.

Expanding Japanese in attack on U.K. market

SORD, the microcomputer manufacturer that is the fastest-growing company in Japan, has started selling directly into the U.K. The Sord range of eight and 16-bit microcomputers, costing from £100 to £10,000, is available now from the new U.K. headquarters in London and from the country-wide dealer network Sord is currently recruiting.

The bread and butter system will undoubtedly be the Sord M-23 Mark III, a Z-80-based computer costing just under £2,000 and reviewed in the July 1982 issue of *Practical Computing*. Coming soon is the M-5 Home Computer, a Z-80-based colour machine costing £99.95 and aimed clearly at the sector of the market typified by Sinclair's Spectrum.

The President of Sord, Takayoshi Shiina, in London for the opening, offered to do a deal with Clive Sinclair. "Britain has a really good company — Sinclair. If possible I would like to join with Sinclair in this market for mutual benefit. The market is so large and I don't like competition." At the moment it looks like the M-5 will just miss the Christmas rush and begin arriving in quantity in January.

Several other interesting machines were mentioned at the press opening but with no announced time of arrival. The M-23P is a portable version of the M-23 Mark III weighing 7.5 kg. including two 3.5in. microfloppy drives. The M-343 is Sord's 16-bit offering, based around the well-known Intel 8086.

All Sord machines run in addition to Basic Sord's own creation, Pips. This is a spreadsheet cum database package that can be used like a programming language to create tailored applications. Sord attributes its phenomenal growth rate to the success of Pips which sells Sord systems the way VisiCalc used to sell Apples.

Contact Sord U.K., 6 St. Albans Street, Haymarket, London SW1Y 4SQ. Telephone: 01-930 4214.

Full accounts package runs on Apple II

THE ACCOUNTANT is a complete accounting system for the Apple II. It comes on one single floppy disc, though two are needed to run the system, and uses some very sophisticated Artificial Intelligence techniques. In the words of its author Malcome Joy of Cybersoft Intelligent Systems, "It is an expert system based on the expertise of my accountant".

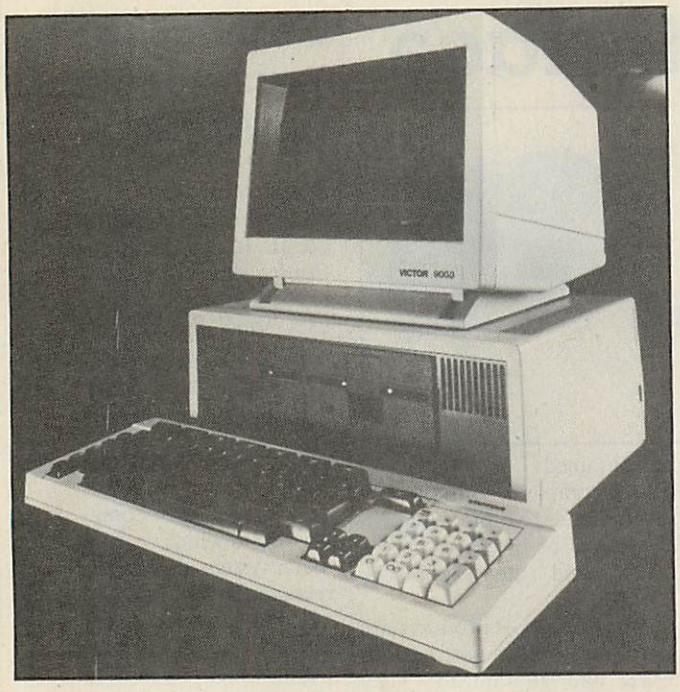
The package comes in a briefcase which contains the main system disc and a small rectangular box as well as the relevant documentation. The box contains a key switch and a plug which fits inside the Apple which is the software protection and is essential to run the software.

The program has been designed to be simple to use. "Most people simply keep their records of financial transactions in a shoebox or something", claims Joy, "and they get into a right old mess. With the Accountant they can just enter all these documents into the computer, credits and debits alike, and let the Apple do the rest." Each transaction is automatically posted.

The system comes with an initial set of dictionaries to get users started but as work with the system progresses the program learns more about the users' accounts and becomes more efficient. The system includes some rather sophisticated report generation facilities which turn all those odd scraps of paper into a neat and tidy set of accounts for your own accountant to present to the taxman.

The Accountant is ideal for the small businessman and is also useful for accountants themselves who can keep separate discs for each of their clients containing a personalised dictionary and that person's accounts. The Accountant can be purchased for £450, a number of applications kits, that is tailored systems, are available at £50 each.

For further details contact Cybersoft Intelligent Systems, 2 Abbey View Drive, Minster-in-Sheppey, Kent ME12 2JW. Telephone (0795) 875997.



The ACT Sirius has a rival in the race to become established as the top-selling 16-bit machine in the U.K. market. The Victor 9000, now being distributed in the U.K. by DRG Business Machines, is identical to the Sirius except for the external casing and keyboard. It is because both machines are manufactured in the United States by the same company, Victor Business Products Incorporated, owned by Kidde Incorporated which is in turn a major investor in Chuck Peddle's Sirius Technology Systems. All this means that ACT can do little to keep the Victor out of the country.

A major struggle to secure dealers now seems likely. DRG is offering the system to dealers at below the Sirius dealer price in a bid to set up a large dealer network rapidly but the end-user price will be identical to the Sirius — £2,395. ACT in turn has warned its dealers that they will have their dealerships terminated if they also sell the Victor and has stopped supplying Sirius to Tabs, the software and systems house. In any long struggle DRG will not be short of resources.

Contact DRG Business Machines, 13-14 Lynx Crescent, Weston-super-Mare, Avon BS24 9DN. Telephone: 0934 415398.

Sage, the first of a new generation

THE SAGE II is the most powerful low-price microcomputer available today. In a box occupying less than half a cubic foot is the processing power of a mainframe — IBM 370/115-2, to be exact. It could be described as the first true fourth-generation computer.

The secret of the computer's incredible power is its processor, the highly acclaimed Motorola 68000. The 68000 is the only 16-bit micro that has been designed as such from scratch and is therefore a cut above the rest. It is not just the hardware that makes this machine so powerful and interesting. The price is highly competitive with other 16-bit micros such as the IBM PC and the ACT Sirius.

The basic system comes complete with a single 320K floppy disc drive and costs £2,495. The amount of standard features included is good and hardware includes 128K of RAM, a real-time clock, two RS-232C serial ports, a Centronics-style printer port and an IEEE-488 interface. Software included as standard with the Sage is the UCSD p-system. As an operating system the p-system has some real advantages. It is designed as a simple single-user system masking the hardware from the user. The main advantage of the p-system is that it is highly portable, any software already written in Pascal can be recompiled for the Sage in a very short time. This is especially helpful when converting software written in Pascal for the Apple.

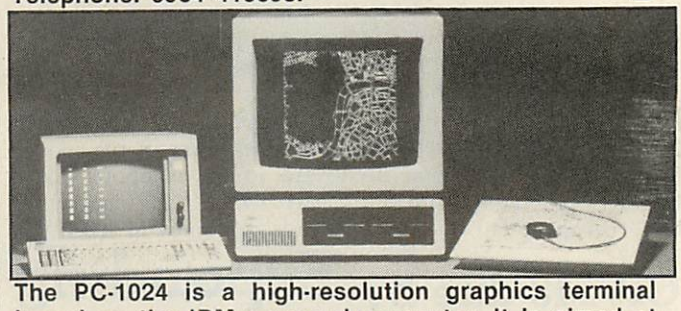
Pascal, Basic and Fortran compilers are all included as standard as is a 68000 macro Assembler. There are a number of utilities for the p-system and in Sage source code as well as an IEEE-488 Pascal interface library and a print spooler.

Also included with the basic system is the owner's manual and a p-system manual. Delivery charge to any point on the mainland is free but maybe the biggest surprise is the 12 months on-site servicing that is also included in the price. The maintenance is handled by GCS Engineering which has 120 engineers the length and breadth of the country.

The initial software directory for the Sage contains some interesting items and matches familiar names with some less obvious ones. There is the Jarman Integrated Accounting suite, and Micromodeller and Microfinesse, the two popular financial modelling programs. Micro Expert from Isis is an interesting new expert-system generator package. The range also includes a wealth of database-management software and a choice of two word processors as well as a number of other items.

The Sage is distributed in the U.K. by TDI of Bristol and it is claimed to be as powerful as eight Apples. Prices start at £2,495 for the lowest entry model and rise to £3,995 for the version with 0.5 Mbyte of ROM and two disc drives remembering that a console is extra.

Contact TDI, 29 Alma Vale Road, Bristol. Telephone: 0272 742796.



The PC-1024 is a high-resolution graphics terminal based on the IBM personal computer. It is aimed at professionals in design, architecture and similar fields providing them with both a highly powerful graphics system and a useful personal computer as well. The specification is very impressive; a 20in. tube capable of showing 1,024 by 780 pixels combined with software that emulates a Tektronix graphics terminal.

Screens can be written at a rate of 1,000,000 pixels per second. In alphanumeric mode the terminal can display 128 characters on five lines and if required the text can be mixed with graphics. An RS-232 interface allows the graphics work station to interface to a large number of computers. It may operate under PC-DOS, CP/M-86 or UCSD p-system. The Tektronix Plot 10 language is used. Joystick digitisers are available for input and there are both plotters and printers for the output.

Two pages can be stored at any one time and switching between the two is very fast indeed. The distributor claims it is comparable with direct-view terminals. The system retails at £7,000 including the IBM PC, though it can also be supplied in an "unbundled" form. For details contact Riva Terminals Ltd. Telephone: 04862 71001.

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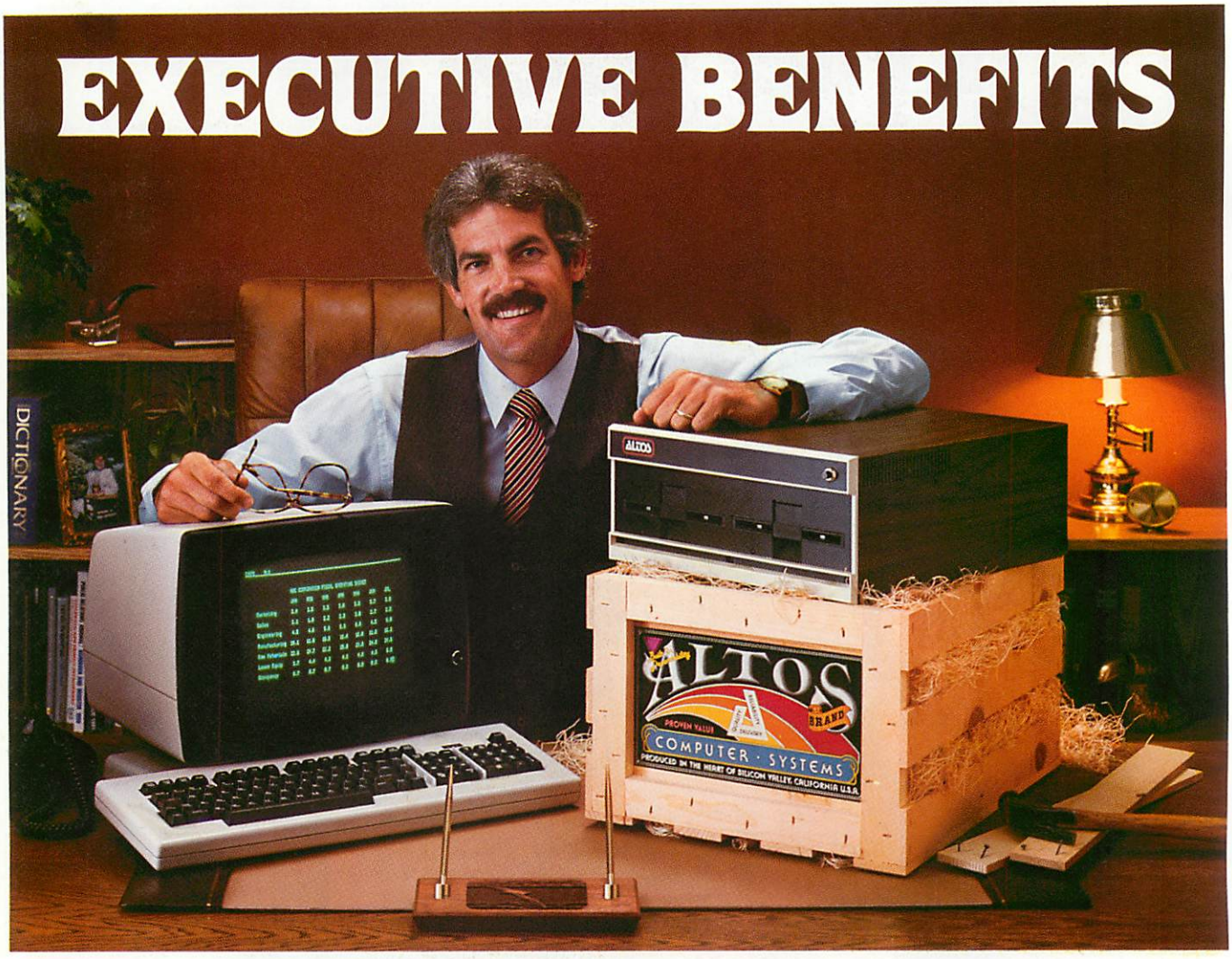

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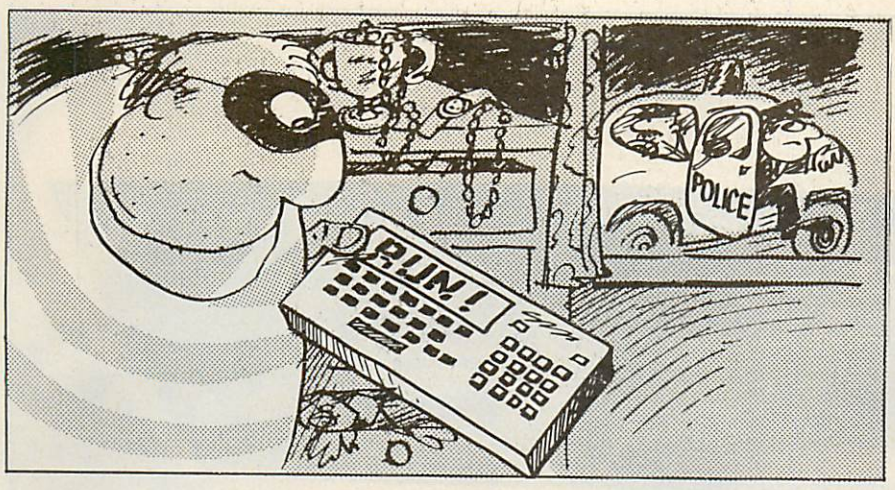


Can you tell the difference between human and artificial intelligence? Bill Bennett takes a look at the expert system.

Expert replacement?

TO GENERATE an expert system, first catch your expert. Persuade him or her to sit at the computer terminal and to type in his or her expertise. Of course, it is not quite as easy as that, the expert has to be computer literate for a start. When I was cajoled into writing a system to select suitable letters for *Practical Computing*'s Feedback pages, I was concerned that it might take me a half a week to do. In fact it took about half an hour to write, albeit in a very simple format, and the system contained about 10 rules.

The most important stage in the writing of an expert system is not the coding, but actually persuading experts to stop and rationalise their thinking processes. This is really part of an expanding area of study known as knowledge engineering, and one by-product of reassessing expert knowledge is that the experts can actually look back at their own thought processes and maybe improve their methods.

A functioning expert system is a highly sophisticated piece of software which should be capable of reacting in the same way to any given question or input data as would a real, live human expert. A measure of such a system's effectiveness can be evaluated by a special application of the Turing test for artificial intelligence.

The test works on the following principles. An operator is given a pair of terminals, one of which is simply connected to a third terminal controlled by a human while the second terminal of the pair is connected to the artificial intelligence. If the operator cannot discriminate between the human and the artificial intelligence the system truly lives up to its name.

A Turing test suitable for artificial intelligence is similar, except that one of the terminals is operated by the expert and the other by the expert system. If the enquirer — that is, the person using the systems — cannot tell the expert apart from the expert system, then the system can be thought of as containing that expert's expertise.

However, the Turing test contains a major flaw. Suppose the expert in question is Ian Botham, and the expert system one that plays first-class cricket. Ask the system terminal "How do you drive a motor car?" and the response is unlikely to be very helpful. Ask the same question of the real expert and he will probably answer "Very fast." The obvious but easily forgotten principle is that the range which an expert system can cover will always be fairly limited.

Expert systems have a tree-like structure. The expert knowledge on which they are based can be broken down into certain axioms or rules which can be thought of as nodes within the tree. Sitting at the top of the tree is the system's "goal hypothesis", a statement about the problem which has associated with it a probability and a margin of error. As the system enquirer progresses, the probability associated with that goal homes in on a specific value, and will often reach it.

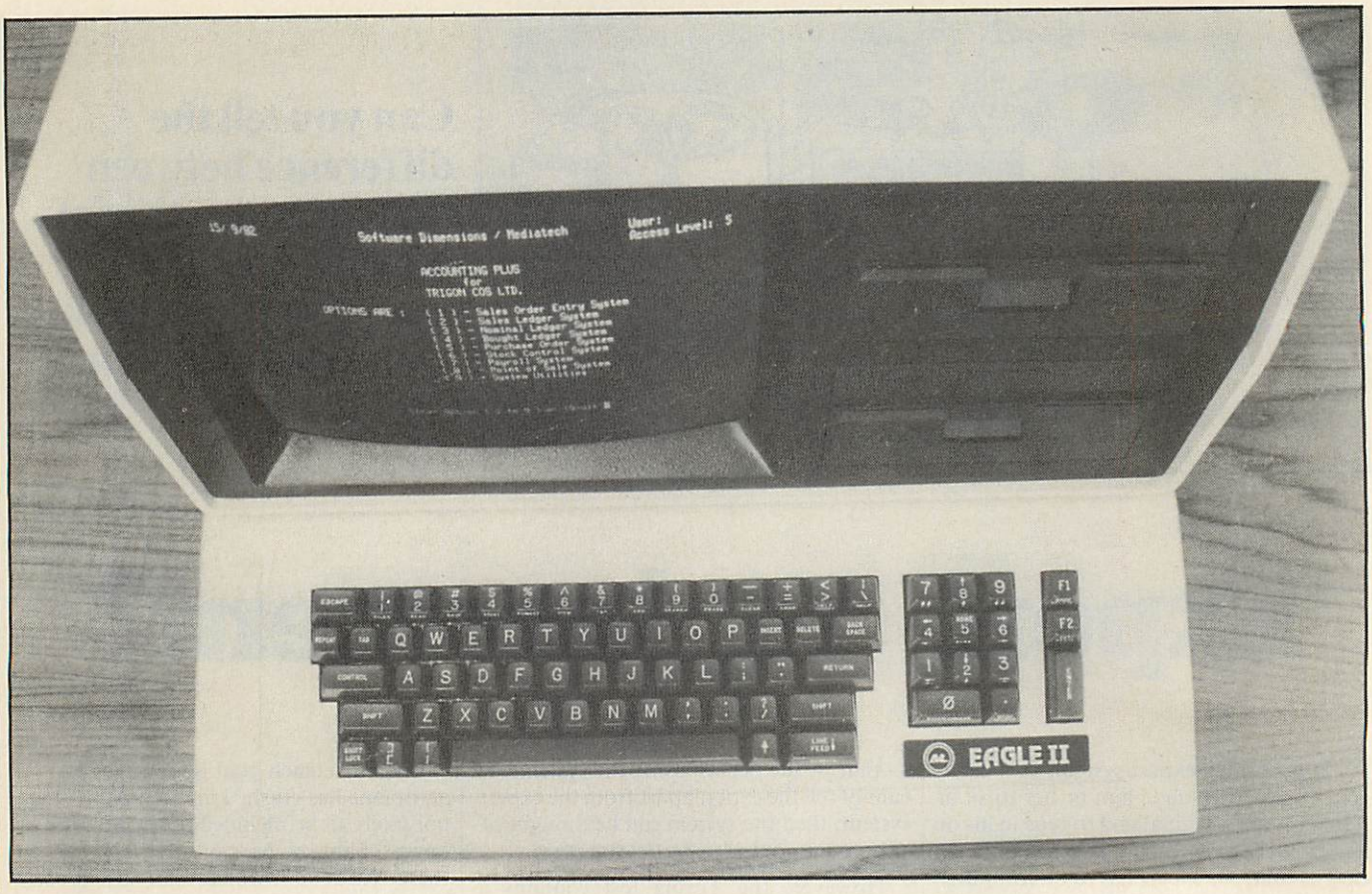
It is quite acceptable for an expert system to have more than one goal hypothesis. In fact, a particularly common type of expert system has one major goal hypothesis and a number of subsidiary goals. For instance, a nuclear power station expert system might have as a main goal hypothesis "This reactor is about to blow up," and an associated probability of 89.6 percent — in other words, it is pretty likely. Subsidiary goals might be things like "the operator pulled the wrong lever", probability 2.9 percent; "the cooling pipes have burst", probability 94 percent; and "too much plutonium was put in the reactor", probability 0.0 percent.

Of course such goal hypotheses as "an aeroplane has crashed into the plant", are not likely to be included as the number of low-probability possibilities is huge. In these cases — which can be loosely translated as "the machine does not know what is going on" — the system should be programmed to tell the user to ask a real expert.

"All an expert system really consists of is a cleverly arranged database", is how one of the designers of the Isis Systems Micro Expert package explained the position — an interesting viewpoint from someone so close to the centre of things. But is that really all there is to it? True, expert systems do resemble databases to some extent; what makes them different is the way that the information is retrieved.

One of the particularly interesting concepts involved in the field of expert systems is that of fuzzy logic. As well as true or false a fuzzy-logic variable can be fairly true, slightly true and so on. Operating on a variable that is slightly true with a fuzzy Not will give you mainly untrue. Think of the distinction between true and false as being along a line: as you move down the line from 100 percent true towards 100 percent false you pass through various stages of slightly true, mainly true and so on. The section of the line which is not slightly true is, obviously, mainly untrue. Another way of looking at it is that not 10 percent true is 90 percent untrue.

Expert systems are an important development in software. They are useful both in their own right and as tools to train the inexpert with someone else's skills. The Japanese see expert systems, along with very large-scale integration and distributed processing, as being a vital part of the next generation of computers. To this end they have put their money where their mouths are to the tune of £250 million.



EAGLE II

ALL FIVE Eagle micros manufactured by AVL of California are CP/M-compatible machines. They range from the Eagle I with 384K of storage on one floppy-disc drive to the Eagle V which has over 15Mbyte on one floppy drive and one Winchester hard disc; the Eagle II contains two floppy-disc drives giving a total storage capacity of 768K. It is a Z-80 based integrated system with the disc drive, keyboards and screen all contained within one package.

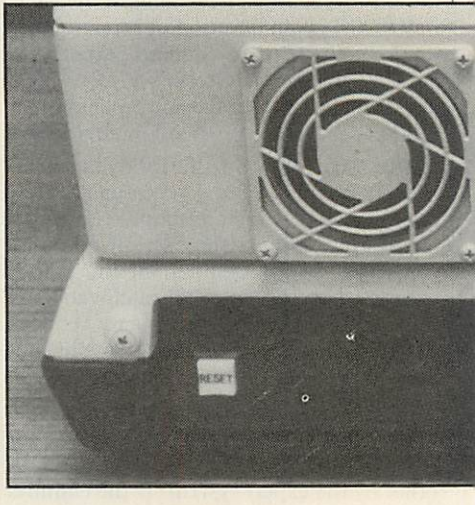
Non-detachable keyboard

The screen has an anti-glare coating and a green phosphor, and displays a conventional lower-case character set with descenders in 80 columns; there are no graphics features. The disc drives are to the right of the screen, one above the other; the top drive is drive A, though they are not labelled. Below them is a conventional contoured keyboard with a numeric pad to the right. At the back of the case there is a power on/off switch, a small push-button reset and four ports marked A and B, serial and parallel. The cream plastic casing is heavy and robust, and should be able to withstand some abuse. The keyboard and VDU are both mounted at a fixed angle and are not detachable. The keyboard feels light and responsive with little but positive travel on the keys — a very high-quality keyboard, in fact. The front of the keys carry legends for the special functions associated with the Eagle's word-processing package and it is necessary to view the keyboard from a low angle if both letters and special functions are to be visible. During operation both disc-drive lights are dimly illuminated until one disc drive or another responds, possibly indicating that the disc systems are occasionally semi-active to monitor discs being taken in and out.

The Eagle micros are marketed in the U.K. by Mediatech, which sells them as part of integrated business packages. The Eagle II Complete Business System which was supplied for review included a set of accounting software, a word-processor disc called Spellbinder, a CP/M operating system, a CBasic disc and a dealer support disc.

On powering up a message appears on the screen asking the user to insert a disc. When the CP/M disc is inserted into drive A the system can be booted to a conventional CP/M machine. A combined disc utility program contains Formats, Pips and Sysgens, though Sysgen itself is a separate Com file on the CP/M disc. Despite this peculiarity the Stat and Ed operations around the files are conventional and in operation the machine appears no different from any other CP/M system. CBasic appears to be equally unremarkable in use.

Booting the Accounting Plus master disc immediately displays a menu. To connect up our printer to the system we followed the menu for setting up the system parameters and were led through an unusually neat and clear printer set-up procedure. Microlines, Paper Tigers and Spinwriters were connected to the system with no problems at all. The package con-



tains a nominal ledger, a purchase ledger and a sales ledger together with point-of-sale entry, sales-order entry, purchase-order entry and stock control; an optional payroll can also be added. Included with the system is data for stock, purchases and sales configured for a mythical company.

Documentation

It was possible to explore the accounting system thoroughly without once needing to refer to the manuals, though setting up a dummy company into the system took slightly longer and did occasionally require prompting from the manuals. The documentation is very well written and clearly produced, though being printed by a dot-matrix printer it became tiresome to read after long periods of time. If the only criticism of a manual is its typeface then the accounting package has to be one of the better-documented pieces of software available to date.

After a day or so of exploring the system without running into any system errors, software errors or manual oversights a reviewer is faced with the problem of trying to find some limitation of the equipment so we spent a few hours attempting to force errors into the stock control, the nominal ledger and into the purchase orders. We corrupted the data, entered wrong order numbers and tried several

Simon Rushbrook Williams looks at the Eagle II Complete Business System — a CP/M, Z-80 based system. The package includes accounting software, a word-processor disc, a CBasic disc and a dealer support disc.

other ways of deliberately confusing the system. Despite using the most ingenious methods of crashing out the software, not once did the system fall down to the CP/M level but always trapped the error and issued a polite warning. Even after a complete hang-up of the system which followed attempts to print without a printer attached, subsequent rebooting produced an immediate prompt indicating that the previous actions have been improperly terminated. Not only are the error messages multiple and clear, they also on occasions use two versions of the same message, especially where an ill-considered action could end up with deletion or replacement of data and the consequent loss of time and money.

The Accounting Plus package allows no alteration to the positions of names and addresses of customers on the printouts, though this would be a minimal problem if an entire system were being brought in and special stationery printed. Mediatech supports business stationery requirements, and even prints letterheads and logos for its customers. Trying to match the Eagle into existing stationery might not be so easy.

Initial boot of Spellbinder is disappointing in that the normally central and clear screen layout becomes cramped in the left-hand columns. However, on pressing Return and entering into the word-processor mode all 80 columns are used. A prompt for a command follows but without any indication of commands. Pressing the Help button on the keyboard provides a prompt how to find help on various functions of Spellbinder. Some three of four minutes pressing the Help buttons associated with files, Find, Save, etc. shows clearly how the system operates. Writing a letter, storing it, bringing it back, editing it and restoring it are all easy and straightforward.

The insert mode is slightly unusual. All text after the cursor is immediately displaced by about 12 blank lines which are used to type in the new text, and on rehitting the Insert button all the intervening spaces are removed. Spellbinder works in two modes, Command or Edit.

In the Command mode the keyboard invokes the special functions, while in the Edit mode the keys echo their normal character on to the screen. Merging, reforming, finding and replacing of text are all included and well prompted via the Help button. It is also possible to write macros of instructions in which small command files can be built up and executed to save you a number of key strokes. If a client changes his name and address or you decide to rename a product, a simple macro run through the existing files will find, replace, edit or delete, depending on what circumstances require. Writing macros, saving them and executing them later is remarkably easy on Spellbinder.

Dealer-only disc

Spellbinder poses no particular problems, though certain features are less conveninet than WordStar. The mail-merge facilities which are an extra with WordStar are included on Spellbinder, and the use of macros as command streams which can be called is of considerable advantage if major errors need to be corrected.

The dealer support disc allows the various ledgers and stock controls to be arranged at will on a number of discs and lets you move operating systems around. It also contains an intriguing system calculator, a fascinating piece of marketing software which prompts the size of company, number of products, number of transactions per day and then calculates which Eagle system should be purchased. It also indicates the optimum distribution of the various ledgers and programs between the two discs to maximise the efficiency or minimise the number of disc operations required in any particular process. The software allows the dealer to rerun calculations on, say, a 10 percent increase in stock level to see how critical is the decision of which level of Eagle to recommend. While this disc is clearly intended to help the dealer to elicit the necessary information from potential customers it is also a very interesting tool with which to look at the calculated memory requirements for various trial companies. The dealer support disc will not normally be supplied to end-users.

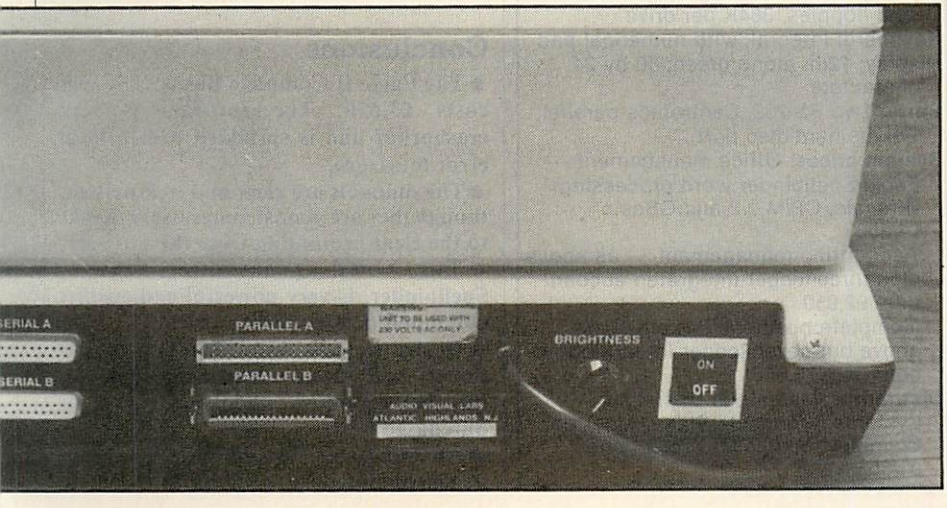
Minor quibbles

It would be exceptional to review a machine and end up without some quibbles or adverse comments. The review model had an extremely noisy fan, and though it sounded like a faulty unit buyers should ensure that they are supplied with a quiet fan; certainly the disc drives are almost silent in comparison. Even with the anti-glare screen operators must contend with numerous reflections requiring continual adjustment of the brightness control, which is easily accessible at the back of the unit.

Twin disc drive, 64K CP/M machines are now very numerous and the majority of CP/M software now available should run on the Eagle without problems. Any

(continued on next page)

The back of the case reveals two RS-232 serial ports plus Centronics and Corvus hard-disc parallel ports.



15/ 9/82
Software Dimensions / Mediatech
User:
Access Level: 5
ACCOUNTING PLUS
for
TRIGON COS LTD.
OPTIONS ARE : (1) - Sales Order Entry System
(2) - Sales Ledger System
(3) - Nominal Ledger System
(4) - Bought Ledger System
(5) - Purchase Order System
(6) - Stock Control System
(7) - Payroll System
(8) - Point of Sale System
(9) - System Utilities
Enter Option (1 to 9) or (0)uit
EAGLE II

The non-detachable screen has a green phosphor and displays a lower-case character set.

(continued from previous page)

Eagle software released by Mediatech should also run on other CP/M systems.

The Eagle is supplied as the basis of a one-price system which should enable the average company to run a computerised system immediately. While the audit trail is not immediately apparent there seems to be little in the system to cause concern in this area. The hardware is unremarkable but good, while the software is remarkable in its completeness, its thorough error messages and its uncrashability.

Faults are acknowledged

It is pleasing that the package includes a section devoted to bugs which quotes the last fixed date for the version and a request for users to report bugs, suggestions and criticism to the dealers. It is not sufficiently common for a supplier of software to acknowledge that bugs exist and need fixing.

A computer being used as a point-of-sale stock-control accounting system cannot be used by a secretary as a word processor to type letters unless the sales counter is shut down. The system would probably be used either continuously as an accounting system or continuously as a word-processing system, unless being operated by a one-person firm. Perhaps it would be more reasonable to offer Spellbinder as an extra piece of software to buy later rather than throwing it in with the rest of the system. Mediatech advertises the Eagle package as "a solution to a problem", a complete business system. With good local dealer support anyone with little or no knowledge of computers should find that accounting and payroll could be done with a minimum of staff training. The Eagle II is not cheap, but is competitive with other twin-disc 64K CP/M machines once fitted with complete accounting packages.

Specification

Microprocessor: Z-80A running at 4MHz
Memory: 64K RAM plus 2K video RAM
4K Eprom containing diagnostics
Discs: floppies, 384K per drive
Keyboard: Integral, with numerical pad
Display: 12in. mono green; 80 by 24 characters
Ports: Two RS-232, Centronics parallel, Corvus hard-disc port
System prices: Office management — Eagle Spellbinder word processing, Utracalc, CP/M 2.2 and CBasic, £2,350
Accounting management — as above plus three-ledger integrated accounting, £2,950
Complete business system — as above but seven-ledger integrated accounting, £3,650
Distributor: Mediatech Business Systems, Woodside Place, Alperton, Wembley, Middlesex. Telephone: 01-903 4372

Conclusions

- **The Eagle II Complete Business System costs £3,650. The software is very crashproof and is sprinkled with helpful error messages.**
- **The manuals are clear and well written, though they are almost unnecessary thanks to the clear prompting from the software.**
- **The word-processing package, Spellbinder, is very powerful and enables command macros to be written.**
- **Dealer support, from printing of stationery to 24-hour response maintenance, can be organised when the system is purchased.**
- **An uninitiated first-time user should not be disappointed by the Eagle II system.**

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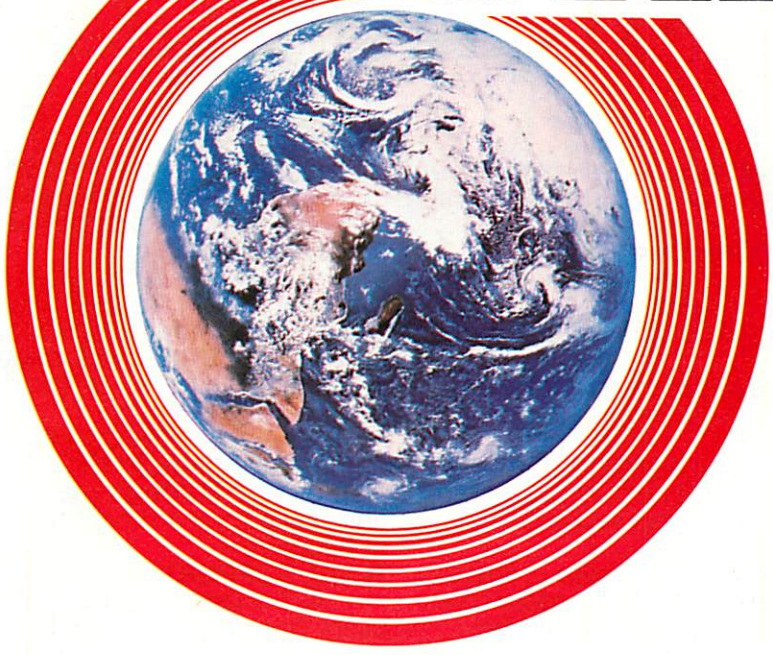

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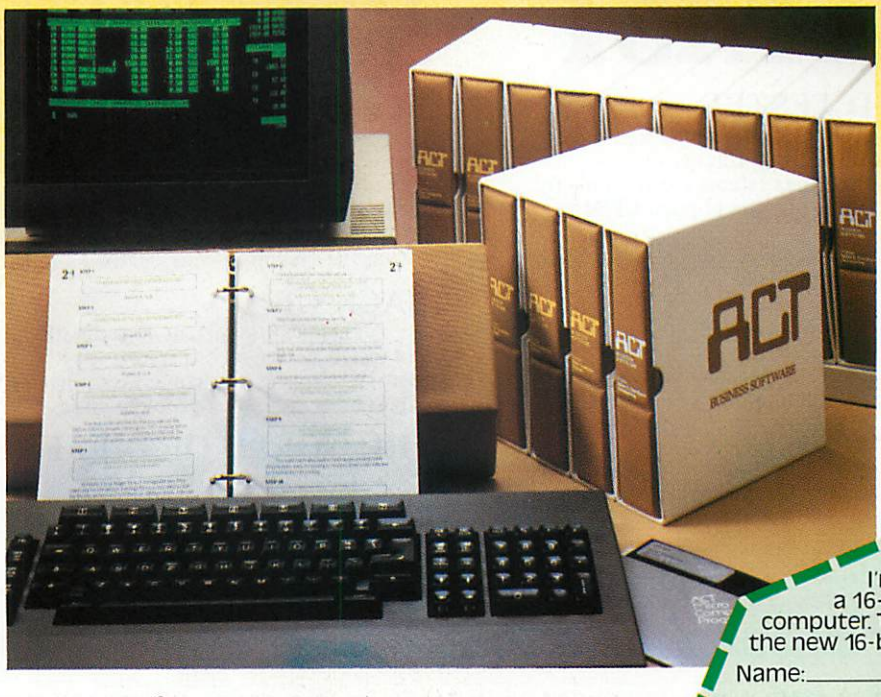

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● Circle No. 148

TMK 330 — new from Japan

Toya Menkah is a name which has yet to become familiar in the micro world. We review that firm's first offering, a twin-floppy CP/M machine.

UNLIKE MOST of the microcomputers we see, the TMK 330 is protected from unauthorised use by a key switch which replaces the more usual On/Off toggle on the back of other micros. Whereas most micros being used in the business world are designed for desk-top personal use, the TMK's key operation suggests that it has been built with use by a full-time operator in mind. This is hardly surprising: the machine was built in Japan for Nippon-Univac, which usually deals with larger systems. The TMK 330 will probably find itself being used in the main as an intelligent terminal to a larger computer system.

In its off-line mode, the machine has a differently defined role to fulfil. It is a kind of microcomputer equivalent of a "turnkey" system — the key on the front making this even more apt a description — in which the purchaser buys from the manufacturer a complete solution to a specific problem. When the finished turnkey mini or micro system is installed a whole bundle of software is included in the package. The user purchases a machine which is not an all-purpose computer but a word processor or an accounting system.

Packaged software

The TMK is a micro that will be bought in a similar way. To the operator its internal machinations will be entirely opaque. It can, of course, be programmed by the user — but I just do not feel that it will be. The system will be sold with a number of software packages, and the user may choose from the wide range of existing CP/M software or use the manufacturer's own systems software.

With the word-processing disc in place the machine will be a word processor, no more or less, and likewise with any other applications package. Standard software supplied with every machine sold includes a version of CP/M 2.2. It has been enhanced to make use of the machine's features, but anyone familiar with this flawed but ubiquitous operating system will be comfortably at home.

The TMK 330's operating system is called Supervisor (DOS) and is CP/M compatible. There is, however, a difference between the two operating systems when it comes to reading and writing to disc. The track/sector allocation is not the same so you should be very careful with any software transferred from another machine.

In operation, Supervisor looks just like CP/M, even down to using the same prompt. All the usual CP/M utilities appear on the systems disc, though the Basic used is SBasic rather than the more common MBasic or CBasic. It is a specially written version of the language which, judging by the spelling errors in the manual, must have been produced in Japan.

The TMK 330 has a sister machine, the TMK 320, which differs only in its disc configuration. The 330 has twin 8in. floppy discs mounted vertically beside the monitor while the 320's two 5in. floppies are mounted horizontally in the same position. In every other respect the machines are the same. The 5in. discs can hold 656K of unformatted information apiece; their larger brothers manage a considerably more substantial 2.4Mbytes.

The TMK 330 is much larger and a good deal heavier than most personal computers and has a large "footprint" — that is, it takes up an awful lot of desk space. Our own desks — though perhaps not quite executive-sized — are fairly large but a TMK 330 and a daisywheel printer together took up just about all the space. In fact it does not really fit on a desk-top at all but needs its own dedicated table to live on. Again, this is perfectly in order for a turnkey dedicated computer system.

The machine's construction is very solid and it should be rugged enough to withstand use in more or less any environment. It is particularly suited to being used in industry and could sit in the corner of a machine room or workshop without being affected by machine vibrations. As an office computer it will be able to take a fair old pounding, and it would be ideal in a warehouse or loading bay.

It is a heavy piece of equipment, but its massiveness gives the machine a large amount of inertia, and consequently the discs do not crash every time someone walks across the office, or the table keys are nudged. It also means that the boards inside the machine are less likely to be knocked out of their sockets.

Robust innards

To remove the main case you have to loosen and remove a total of nine screws — not a task that should be recommended to any but the most dedicated. Inside is a bewildering array of Japanese electronics, all designed for easy servicing no doubt.

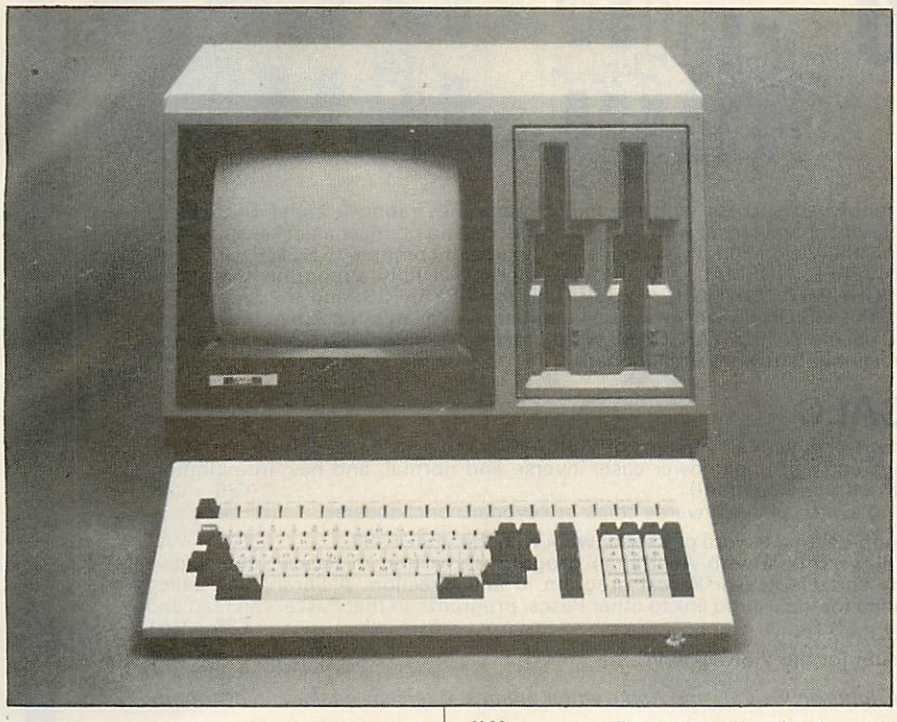
Like any other computer, most of what fills the case is simply fresh air. About 40 percent of the remaining space is occupied by the 8in. floppy-disc drives and their associated electronics. Much of the machine's weight is concentrated in this area, the discs being surrounded by iron castings. The solidly constructed disc assembly is held in place by metal struts, which also protect the video monitor at the back. This metal framework really is tough and robust — there is no evidence of any of that flimsiness that is often associated with Japanese products. This machine has been built to last.

Beneath the heavy metal of the disc drives is the machine's power supply. A large number of hefty-looking capacitors are there to smooth the output alongside some chunky resistors and a fuse which can be accessed from the rear of the unopened case. One power supply provides the "juice" to run everything — from the computer circuitry to the video monitor.

Under the video tube is a driver board on which, like the other boards inside the

Specification

Processors: Two 8085s
Memory: 64K RAM, 4K Shadow ROM
Keyboard: Qwerty detachable keyboard with numeric pad and 22 function keys
Display: Built-in 12in. monochrome monitor
Ports: Twin RS-232, bidirectional, 300-baud to 19,200baud
Two multibus sockets
Centronics-type printer port
Standard Software: CP/M 2.2 fully compatible,
Some system utilities
SBasic similar to MBasic with enhanced random-access file handling
Optional Software: Micro Repro — a WordStar-like word processor plus spreadsheet
Various communications packages
Price: £3,350; the TMK 320, a 5.25in. disc version, is available at £1,990.
Distributor: Peripheral Hardware Limited. Unit 13, Monkspath Industrial Park, Highlands Road, Shirley, Solihull, West Midlands. Telephone: 021-745 3033.



The basis for turnkey micro systems.

computer, every component has an identification number and description printed next to it, making it easy to find your way around the circuits. On this board is the oddly shaped line-output transformer which provides the tube with the 7kV it requires.

The business end of the computer is hidden away underneath this circuitry. It is all contained on two PCBs, one mounted above the other. The heart of the computer is two Intel 8085 processors, a quicker version of the 8080 chip with a few updates. The twin processors allow separate processing of input/output data, which comes in handy when the machine is being used as an intelligent terminal.

A 10W fan, screwed to the rear of the main case, and a small audio loudspeaker complete the short tour around the machine's innards. The boards inside the machine all have the Sanyo name and logo printed on them, indicating the origin of the computer, though the full story is rather convoluted. It goes like this.

The Sanyo connection

Nippon-Univac, the Japanese marketing division of the international Univac corporation commissioned the machine from Sanyo. This was sold only within Japan. It could have been marketed worldwide by the Univac organisation but the company decided to push its own products. So the international marketing rights went to the massive Japanese trading organisation, Toya Menkah — and hence the TMK name. The exclusive U.K. rights belong to Peripheral Hardware, of Solihull.

The Sanyo connection also explains why the version of Basic supplied on the systems disc is called SBasic. It is a fairly standard implementation of the language, with a few minor but important differences. For example it is not structured, but it does have a facility for using a real-time clock within the computer. There are two functions which access this clock, Date$ and Time$. On power-up these two strings simply contain zeros: 00 00 00. They then can be programmed with initial values. Date$ remains constant for the rest of that session, while Time$ will, if called, tick away the seconds of your life. Both these values are zeroed when the computer is reset.

Configuration of the computer's two RS-232 user ports is performed with the Init% instruction which does little more than set the baud rate, parity, stop and transmission bits. If it is not done the system reverts to default settings. The % sign indicates an integer function — a % after a variable indicates an integer. In the same way, single precision is indicated by ! and double by a #.

The distinction has an important practical reason behind it. If integers are used, a variable takes up two bytes in memory space, while single precision requires four and double precision eight. Over a whole disc-worth of records there could be a lot of redundant space without these distinctions.

The function keys which sit in a row along the top of the keyboard can have strings of characters assigned to them by the Key command. The strings can include Basic keywords and control characters, which will be acted on immediately the relevant key is hit. Key List is a printout of these assignments, as shown in table 1. Whole lists of key assignments can be loaded to and from disc, allowing them to be used at the relevant times.

The machine is frightenly easy to use — the operator needs to do nothing more than insert the key, insert the disc, slam the disc-drive door shut, and boot using the Control and Reset keys. Immediately the machine is turned on, the fan starts to hum. It is a breathy, low-pitched kind of hum that would be totally unobtrusive if it were not for the discs. They really make a racket. "Whir, clunk, clunk, whir," might be music to your ears, but not to the people in our office. I suppose that the design team must have employed a psychologist who told them that this noise is "businessy", or maybe it just gets people working harder.

Table 1. Function key list.

PF	1	SYSTEM
PF	2	NEW
PF	3	FILES?
PF	4	FILES "B:*.*"?
PF	5	SAVE "
PF	6	RENUM
PF	7	LINE
PF	8	INPUT
PF	9	PRINT
PF	10	USING "
PF	11	RESET?
PF	12	OPEN "
PF	13	CLOSE #
PF	14	CHR$(27)+"
PF	15	CHR$(
PF	16	KEY LOAD "
PF	17	LOAD "
PF	18	LIST
PF	19	LIST?
PF	20	LLIST?
PF	21	
PF	22	RUN?

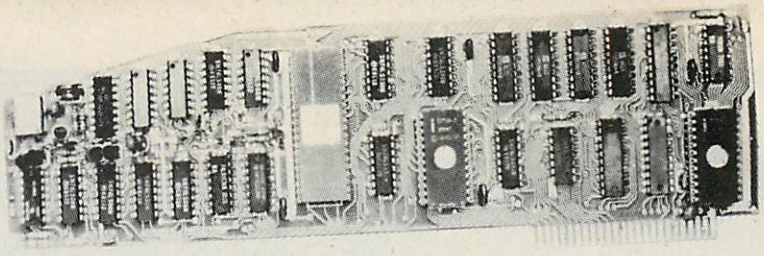
The software supplied with the review machine was a complete package called Micro Repro. It appears to be an all-singing, all-dancing program that combines a word processor with spreadsheet facilities. The two sections interact with each other and they produce files which are accessible from Basic.

Microrepro is an optional extra to purchasers, but there is some useful software that comes as standard with the machine, including a sort program, a merge program; a file-dump program and a few more utilities. Also available as extras are a number of packages enabling the TMK to communicate with other larger computers which are likely to prove very important to users of the TMK 330.

Conclusions

- **The TMK is a good, solid micro that will find its way into a number of more traditional data-processing type installations.**
- **As an all-purpose office micro it is fine, with some very attractive software available in Micro Repro, a package containing both word-processing and spreadsheet functions.**
- **Its size and price disqualify it as a common-or-garden desk-top personal system, but make it more suitable for operator use.**

VISION-80



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GRAFORTH

Pete Naisbitt looks at GraForth, a language intended for creative graphics programming on the ever-popular Apple II micro.

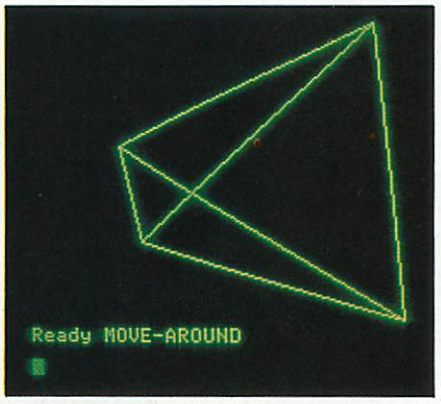
GAMES PROGRAMS, teaching software and creative graphics applications in general are the areas in which GraForth is designed to excel. Unlike Forth development systems, which usually provide only the most rudimentary I/O features on the assumption that you will want to develop your own customised I/O, GraForth uses Apple DOS. This is a painful environment for program development but it does have the advantage that graphics files produced by the user of GraForth can easily be deployed in other programs which run with DOS.

Forth is ideally suited to small computers as it executes very rapidly and requires little memory. GraForth takes full advantage of the Apple's high-resolution graphics and sound capabilities, and it is ideal for the first-time Forth programmer as it provides instant gratification while learning. Yet GraForth has its limitations: it is an integer-only implementation, and it lacks some of the features that an experienced Forth programmer would expect to find in a standard version.

A typical Forth development system, such as Fig-Forth, comes with a dictionary of around 200 words. Words "do" things when they are executed, usually taking input values from the parameter stack and returning output values to it. The dictionary is extended by defining new words, that is by compiling them into the dictionary. There are different types of definition: the most common is the colon definition which is established in terms of previously defined words and provides the fundamental control structures such as If-Then, Do-Loop, Begin-While-Repeat, etc. Variable definitions behave differently, allowing access to data by placing its address on the stack. Systems developers produce specialist applications by extending the dictionary with their own word definitions.

Forth provides a few defining words such as Variable, Code, and Constant to compile new words into the dictionary. A defining word may be written in high-level Forth using the two words < Builds and Does >. When it executes it < Builds a type of word into the dictionary whose name it expects to find in the input text stream and whose execution-time characteristics are specified by the Does > part of the defining word. A specialist language can be created in this way and configuring a system at compilation time is simply a matter of performing the appropriate dictionary manipulation.

There are other powerful systems tools such as immediate words. When encountered during compilation of a colon definition, immediate words are executed instead of being compiled, allowing the computation of parameters at compile time. When colon definitions are compiled the dictionary is searched for each component word encountered in the input stream and a pointer to it is stored in the dictionary. Colon definitions are executed by the address interpreter which will ultimately call words written in machine code.



Up to 16 three-dimensional objects can be held in memory at any one time.

Forth is written in reverse-Polish notation, using the stack to pass parameters between words. It also allows any collection of characters without embedded blanks to be used as word names. Most of all, Forth is fast, highly interactive and compact.

GraForth shares these last features although it is a very specialised and non-standard Forth system. The manual's claim that GraForth is an improvement on standard Forth is rather misleading. As a development system this is not true, but if you want to write graphics software it is. On booting GraForth there is the option to run the demo, which contains some very seductive graphics and music. If you forswear such delights the system appears with the Ready prompt.

All keyboard input is compiled and executed on a line-by-line basis. Colon definitions are fully compiled into machine code for reasons of speed, and word types are limited to those compiled by the defining words supplied in the system such as Variable, : and Case:. No words such as < Builds and Does > exist to allow programmers to define their own word types.

Like most Forth systems there is a minimum of error checking, again to keep up execution speed, so it is easy to crash the system by incorrect use of the stack. All the usual stack-manipulation words such as Drop, Dup, etc. are provided. The radix

The demo contains some very seductive graphics and music.

GraForth takes full advantage of the Apple's high-resolution graphics capabilities.

can be altered by setting the system variable Base to the required value. The defining word String can be used to define strings, tables, arrays, indeed anything in which a block of memory is to be addressed as base plus offset.

The Variable-type definition is inferior to that found in standard Forth implementations, where the address of the variable's value is placed on the stack when the word is executed, allowing address by reference. In GraForth a variable acts as a standard Forth constant: it puts its value on the stack, unless preceded by the word ⟶ when the value on top of the stack is stored in the variable. This and other peculiarities are annoyances rather than problems since GraForth is intended for use as a graphics language, not as a meta-language. The word types supplied are adequate and some of the graphics words are very powerful.

The standard display is the high-resolution graphics screen on which a full 96-character ASCII set may be displayed, including lower-case letters. Each character requires eight bytes to define its graphic image, making a set 768 bytes long. Seven character sets are supplied as binary files on the system disc and any of them may be loaded from disc and selected for display — see routine 1.

Some of the files contain "normal" character sets — slanted, Gothic, etc. — while others are composed of characters which when displayed in a particular block configuration appear as pictures. This allows images of up to eight by 12 characters to be displayed. Routine 2 shows how to display the image comprising characters 30 to 49 in a five-by-four block.

To define character sets the character editor source code is loaded from disc and compiled by typing

```
READ "CHAREDITOR".
```

The editor allows you to display images in the block size you require and to draw them using I,J,K and M to move a dot cursor around, P to plot and L to draw a line. Chareditor turns out to be rather difficult to use, and the action of the cursor is not at all positive.

The other graphics features compensate for this deficiency. The two-dimensional Cartesian graphics are roughly comparable to Applesoft's but much better. The turtle graphics can compose very gratifying sequences — see routine 3 — and the three-dimensional graphics are sufficiently fast to allow realistic animation of shapes, given its use of both Apple graphics screens.

To enter and save large chunks of program text prior to compilation it is necessary to use the text editor. It is a line-orientated editor which uses single-character commands and appends line numbers to each line of text to enable you to identify them during editing. The usefulness of this scheme is limited because all lines are automatically renumbered after every deletion or insertion; a screen-orientated editor such as that supplied with Fig-Forth would be preferable.

Imageditor, the three-dimensional shape editor, is a nice piece of work. It takes, and co-ordinates in the range −128 to +127 and gives instant visual feedback as you Move, Draw and then rotate, scale and translate the image using single-character commands. The three-dimensional data can be saved as a binary file. Profile is another three-dimensional editor which generates images by rotating a profile definition which is given to it. Sadly, this kind of graphics feature seems to be used almost exclusively to generate wine glasses.

Up to 16 three-dimensional objects can be held in memory at any one time. The high speed of the eight-bit transformations means that you can make them all move almost simultaneously if the objects are not too complicated. Routine 4 shows a program which displays a tetrahedron in various states of rotation and scaling.

The music words Voice and Note make it easy to replay musical data and provide a further attractive option for those contemplating some games programming. Voice specifies timbre and Note plays a

(continued on page 69)

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TEXAS INSTRUMENTS

● Circle No. 151

Routine 1.

```
CR 132 PUTC                          ( <CR>/Ctrl-D for DOS )
PRINT " BLOAD CHR.SET,A2048 " CR          ( Bload set )
2048 CHRADR                           ( Select set )
```

Routine 2.

```
12 VTAB 10 HTAB                      ( setup screen posn )
5 4 BLKSIZE                            ( setup blk size )
30 PUTBLK              ( display block starting at chr £ 30 )
```

Routine 3.

```
: SQUARE        ( define word to draw square of given size )
  4 0 DO
     DUP MOVE 90 TURN
  LOOP DROP ;

: SPIRALS           ( produces a spiral pattern of squares )
  80 0 DO         ( input value determines shape of spiral )
     I SQUARE DUP TURN
  LOOP DROP ;

8 SPIRALS                            ( draw spiral pattern )
```

Routine 4.

```
OBJERASE                                    ( clear 3-D area )
CR 132 PUTC PRINT " BLOAD TETRA,A2816 "          ( load file )
0 OBJECT 2816 OBJADR HOME  ( init object number & address )

: MOVE-AROUND                               ( define the word )
  128 XPOS 96 YPOS                           ( centre object )
  BEGIN
     40 0 DO
          I SCALX I 2 / SCALY     ( do various things with )
          I 2 * XROT I 4 * YROT     ( x,y scale & rotation )
     DRAW LOOP
  GETKEY 127 > UNTIL ;          ( continue until key pressed )

MOVE-AROUND                                        ( do it )
```

Routine 5.

```
: COL.BOGIE                              ( define famous tune )
  69 32 NOTE       ( G )       ( NOTE takes pitch, duration )
  83 128 NOTE      ( E )
  83 32 NOTE       ( E )
  78 32 NOTE       ( F )
  69 32 NOTE       ( G )
  41 64 NOTE       ( top E )
  41 64 NOTE       ( top E )
  52 128 NOTE ;    ( C )

2 VOICE COL.BOGIE      ( give performance in raucous voice )
```

Forth principles

To understand Forth it is necessary to grasp the three major Forth concepts: a word is a Forth command; the dictionary contains all the words currently recognised; the stack, or parameter stack, is the Forth equivalent of Basic's named variables and arrays.

Forth interpreters are supplied with a kernel of words already defined. Most of them are the commonly agreed Forth vocabulary, with some machine-specific extensions. New words can be defined in terms of the words currently in the dictionary, and some versions of Forth also have an assembler so that you can write assembler routines and define them as words too.

The Forth dictionary is extensible — and writing a Forth program consists largely of extending the dictionary. Consequently, Forth is inherently highly structured as words are defined in terms of other words, and all Forth programming is an exercise in bottom-up structured program development. A whole Forth program ends up as a single word.

Forth allows data structures other than those defined in the stack, but the stack is usually the most simple and convenient. It is a list of data items in last-in first-out sequence. Values are thrown on to the stack like plates on to a canteen plate dispenser — the first one off the pile is the last one in. It is not necessary to name items on a stack, only to keep track of where they are in the sequence. It is this that makes the stack approach so convenient. Many standard Forth words expect or leave parameters on the stack.

Arithmetic operations naturally expect their operands to be on the stack before the Forth word using them is executed, as in

5 6 +

where + is the Forth word to add 5 and 6. The sequence of operation here is that 5, then 6, are placed on the stack. The operator + then removes the top two values from the stack, adds them and then puts the result back on top of the stack. Forth thus uses reverse-Polish notation for arithmetic operations. This minor challenge to established habits puts many people off learning Forth, but it becomes quite natural once you understand how Forth works.

Forth was developed at the National Radio Astronomy Observatory in the United States by Charles Moore and Elizabeth Rather, originally for controlling telescopes. The first dedicated Forth computer — the first of a line leading to the £90 Jupiter Ace — was built at Manchester University's Jodrell Bank radio-telescope in 1973. Versions of Forth are currently available for most micros except the Sinclair Spectrum and Dragon 32, for which Forth implementations are currently on the way.

A readable introduction to Forth is to be found in *Starting Forth* by Leo Brodie, published by Forth Inc. at £12.80.

(continued from page 67)

note of a specified pitch and duration. Routine 5 plays an instantly recognisable tune — though in practice it would be more efficient to store the duration and pitch data in a string which is read during the performance.

The GraForth manual is professionally produced and seems to be unusually free of irrelevant information. It is well written, easy to access, and should be comprehensible by anyone with a minimum of nous, even if they have little previous programming experience.

Conclusions

- **GraForth is a fast, simple, integer-only, graphics-oriented version of the language, designed to allow the programmer to realise the full potential of the Apple as a graphics machine.**
- **It is a non-standard version which lacks features found in the commonly accepted Forth Interest Group definition, and its line-oriented program editor is inferior to the screen-based editors found on most other versions of Forth. Other versions of Forth for the Apple — such as Transforth and Cap'n Software Forth — provide a fuller implementation of standard Forth but lack GraForth's special graphics features.**
- **The way DOS commands are used from within GraForth is tiresome, but the language is DOS compatible so that screens created with GraForth can be used by Applesoft programs.**
- **GraForth is very suitable for the programmer beginning Forth, because a lot can be made to happen with a simple Forth routine. It will also interest graphics, games and educational programmers.**
- **The GraForth manual is excellent.**
- **GraForth is written by Paul Lutus and distributed by Insoft Inc. It is available in the U.K. for £45 from SBD Software, 15 Jocelyn Road, Richmond, Surrey TW9 2TJ. Telephone: 01-948 0461.**

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- **DATED FILES,** show when a file was last written to.
- Backup: Mirror, by Class, if Modified, by Date, by Extension, etc.
- Selectable **PURGE** for fast disk "cleanup" of unwanted files.
- Print formatter, for control of printer output.
- Built in printer **SPOOLER,** to both disk and ram.
- Joblog to record all system operations with time stamps.
- **UPPER** and *lower* case support, throughout the system.
- Blinking cursor with selectable cursor character.
- 128 character **TYPE AHEAD** buffering for keyboard input.
- Assign strings to individual keys with Key Stroke Multiply **(KSM).**
- **SUPER FAST** operation with the **SYSRES** feature.
- Extensive user control and system feedback.
- Advanced **PATCH** utility for easy maintenance.
- Complete transportability of software among all **Z-80 LDOS** systems through the use of the **LDOS** high ram supervisory call system **(SVC).**

* Specific hardware is required to use these features.

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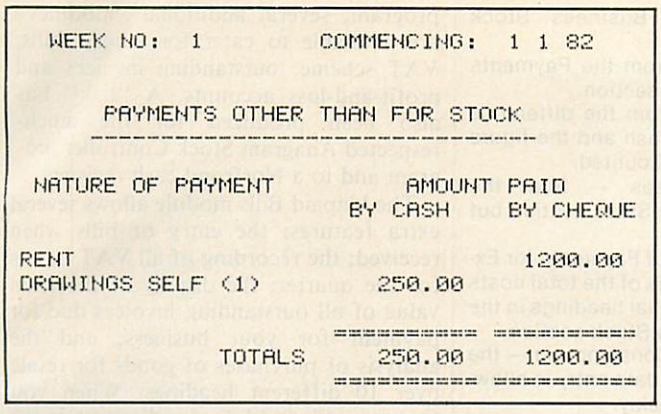


```
WEEK NO:  1          COMMENCING:  1 1 82

      PAYMENTS OTHER THAN FOR STOCK
      -----------------------------

NATURE OF PAYMENT          AMOUNT PAID
                        BY CASH    BY CHEQUE

RENT                                1200.00
DRAWINGS SELF (1)          250.00

                        ========== ==========
                TOTALS     250.00    1200.00
                        ========== ==========
```

MICRO-SIMPLEX

Manual book-keeping can be both tedious and time consuming. Peter Wood looks at a package that makes accounting easy.

OVER 1,000,000 retail businesses currently use a manual book-keeping system called the Simplex D cash book. George Vyner Limited has been supplying this aid to small business for nearly 50 years in the shape of a hard-cover book available at High Street stationers.

From now on the happy customers purchasing a new book will find a small slip of paper enclosed, containing a message from the publisher. It simply states that the Micro-Simplex microcomputer accounting package is available on a Commodore Pet system for a small weekly payment, and is recommended by Vyners.

The essence of the Simplex system is, as the name implies, simple, easy-to-use accounting. It allows the shopkeeper to keep track of business transactions and produce a trading profit-and-loss account and balance sheet in a manner acceptable to the Inland Revenue.

Weekly reports

The facilities provided include a weekly cash report and a weekly bank report. The weekly cash report is designed to allow the user to balance cash each week, thus proving the accuracy of the week's book-keeping entries and checking that no cash payments or receipts have been omitted.

The weekly bank report allows verification of the bank statement and the week's entries. This report also allows the users to check their bank account weekly, even if bank statements are not received that regularly.

Any goods taken from stock ought, of course, to be paid for at the normal selling price, though owners of small businesses will often withdraw stock for their own use. The Goods for Selves entry allows this to be recorded to assist both users and their accountants. Any capital payments, such as purchases of new equipment, fixtures and fittings or motor car made during the year are entered in the Expenses section under Capital Items. All cash taken for private and living expenses, and any payments made from the business for private purposes are entered separately against Drawings for Self.

When wives or husbands assist in the running of the business the wage paid is entered in the appropriate heading of expenses. If the business is a partnership then the drawings of each partner are entered separately under Drawing for Self. The owner's own National Insurance contributions are also posted to Drawings for Self. The total PAYE and National Insurance contributions for employees are entered separately against Inland Revenue.

This very simple system provides for the accounting needs of the majority of small retail businesses and avoids the costly accountancy fees experienced where incomplete records exist.

Micro-Simplex comes as a program disc, with dongle that fits on the Pet cassette port and a friendly manual. The manual is very explicit and assumes absolutely no prior knowledge of computers or computing. The introduction covers the concepts of the program's menu displays, informs you that a Micro-Simplex users' club exists and even asks for your comments and suggestions for modification and improvement.

The first main section is entitled Getting Started and details such essentials as how to connect your computer system, How to use the computer keyboard, How to insert a floppy disc and How to remove a floppy disc — all very useful for the novice computer user. Having loaded the program as instructed, you are recommended to play with the system to establish familiarity before committing new live data to it.

A Simplex D book is provided with the package to enable a parallel system to be run — especially useful if the user has never used Simplex — allowing three or four weeks of familiarisation before total computerisation. The various utility commands are explained, including the preparation of new data discs, display of disc directories and duplication of diskettes. Having read thus far, you are invited to prepare four new diskettes, program and data security being emphasised with the instruction to make a copy of the program and two back-up data diskettes.

After loading the program, the main menu is displayed, which in turn may lead to other sub-menus as appropriate. The main menu options are:

- The Weekly/Daily Entries menu
- The Summaries menu
- The Audit Trail menu
- Closing down the system and making security copies

The Weekly/Daily Entries menu is the option most likely to be used on a daily basis and has the following options.

Receipts/Paid to Bank is used to record receipts and amounts paid to the bank. After selecting this option, a screen is displayed showing the days of the week and four columns for information. The cursor appears, VisiCalc fashion, as a highlighted block over each entry. Re-entry of wrong data is allowed once the screen has been completed, via the prompt

Is the information correct Y/N.

The four headings are: "Receipt — VAT", used for recording sales of all items containing VAT; "receipts — Zero", used for sales of zero rated items; "Other", for the recording of other receipts not part of your takings, such as VAT refunds; "Description", used to comment on the amounts posted in the other three columns. Once all the data has been entered to your satisfaction, two options are offered: Shift-X returns to main menu, or Shift-P to continue to the Payments to Bank section. Any payments to bank are entered in an identical manner. The question-and-answer techniques and their responses are, thank goodness, identical throughout the system, avoiding the need for detailed operator training.

Payments for stock

Payments for Business Stock is used to record all payments by cheque and in cash for goods that are to be sold. Overheads are entered separately. This option produces a display asking for cheque number, date, description, and cash/cheque value — all straightforward enough. Having accepted this screen you are prompted for the VAT value of the posting. A transaction number which relates to the audit trail is then displayed, allowing you to write this on the invoice to aid later correlation. Deletions of erroneous postings are also given audit-trail numbers, so any accountant should be happy with that.

Payments Other than for Stock is used to record all other payments made either in cash or by cheque. A scrolling display of all the possible headings is shown, together with room for up to 15 headings

(continued on next page)

(continued from previous page)

for your use. The manual warns you to be sparing with the allocation of new headings, as 15 over a year can easily be devoured by an over-enthusiastic bookkeeper.

Weekly Bank Report is a summary of all the transactions during the week affecting your bank account. The balance brought forward is the balance on the account at the end of the previous week. Data that may be entered are the amounts of any cheques issued to draw cash from the bank, amounts of any standing orders paid by the bank during the current week and the amounts of any bank interest and charges debited during the current week.

Weekly Cash Report shows the situation concerning your cash for the week. The only amendable item is the Cash as Counted entry, which should be entered after the till has been counted at the end of the week. This figure becomes the cash brought forward at the start of the next week.

Print Weekly Reports allows you to print a paper copy of each of the above menu options. Extremely detailed instructions about the positioning of the paper perforation 5mm. above the print-head undoubtedly ensure accurate reporting.

The Summaries menu allows the examination of the various summaries that are built up over the year. They may be either displayed or printed and are:

Takings — from the Receipts section.

Payments for Goods Purchased — from the Payments for Business Stock section.

Drawings for Self — from the Payments for Other than Stock section.

Cash Differences — from the difference between computed cash and the figure entered for Cash as Counted.

Payments for Expenses — from the Payments Other than Stock section but excluding drawings.

Year to Date summary of Payments for Expenses — the analysis of the total costs on each of the individual headings in the Payments Other than Stock section.

Goods Taken for Own Consumption — the only summary where data entry is allowed, being entered weekly.

Print Summaries — produces another identical menu for the printing rather than display of these reports.

The trading and profit-and-loss accounts use the information in these summaries for the production of monthly and yearly trading and profit-and-loss accounts. The Audit Trail menu allows the display or printing of the audit trail for all the entries you have made. The display of an item in the current VAT quarter is obtained by the selection of Current Entries. Other VAT quarters may be specified for past data. The entire audit trail may be printed to satisfy both the VAT inspector and your accountant.

Closing down the system is accomplished via a routine which copies the data disc for security. It is very much in Micro-Simplex's favour that the importance of security copies is so strongly emphasised. In addition to the basic Micro-Simplex program, several additional "modules" are available to cater for unpaid bills, VAT scheme, outstanding invoices and profit-and-loss accounts. A "link" has also been produced for the much-respected Anagram Stock Controller program and to a Norfrond cash register.

The Unpaid Bills module allows several extra features: the entry of bills when received; the recording of all VAT inputs for the quarter; the display of the total value of all outstanding invoices due for payment for your business; and the analysis of purchases of goods for resale over 10 different headings. When you first run this module, headings 01 to 10 and 34 to 50 are blank. Headings 01 to 10 are for the analysis of purchases of goods for resale and may be used in any way you wish. Headings 11 to 33 are fixed according to the standard list of overhead costs but 34 to 50 may be allocated by the user as required. Any unpaid bill may be entered at any time, but you are advised by the manual to enter only bills with a date within the current VAT quarter.

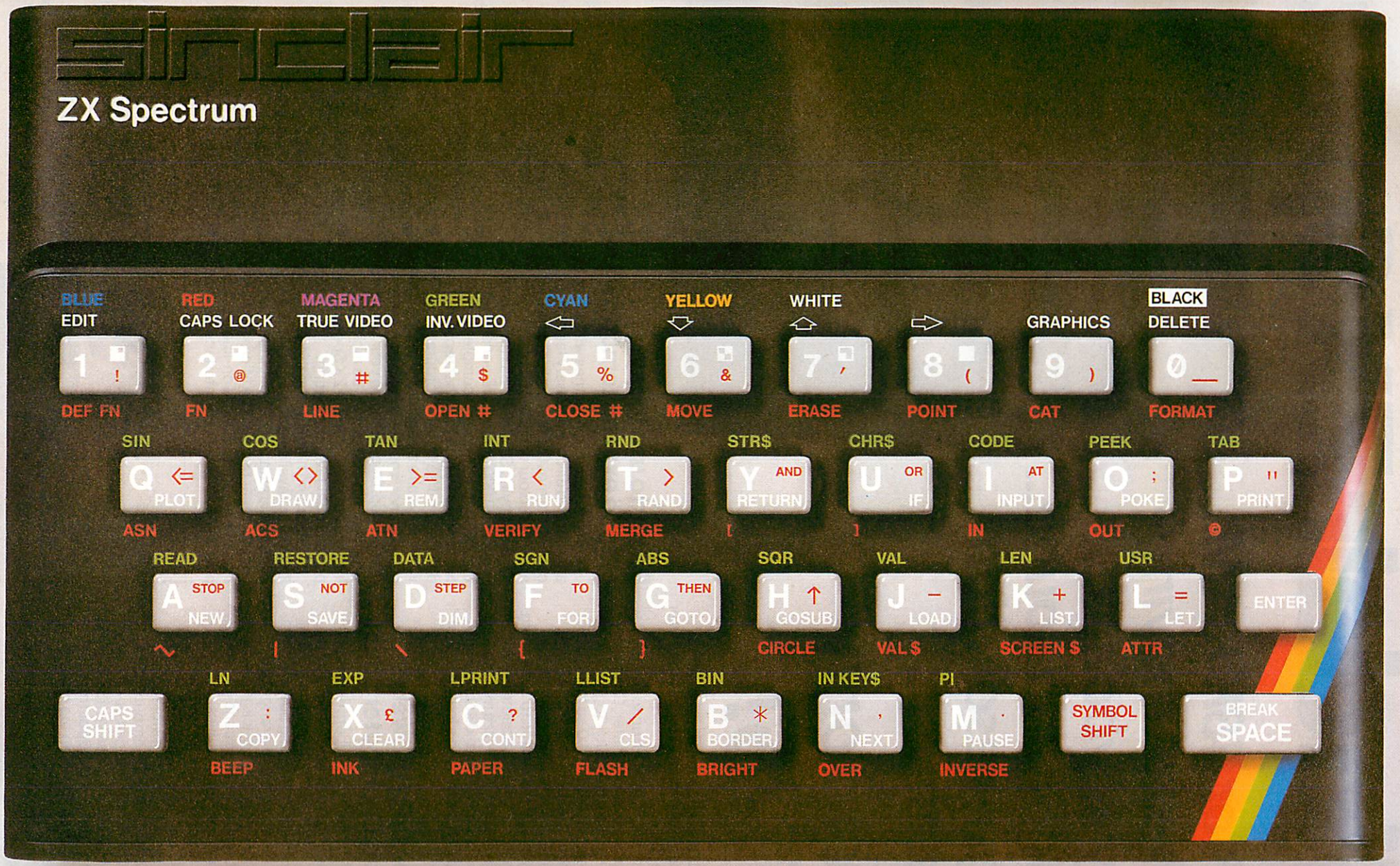
The interface to the Norfrond cash register is interesting and not a little impressive. The story goes that the justly famous Cortex was called in to design and build an interface to this intelligent till and, as usual, came up with a superb combination of hardware and software. The Norfrond System 81 series 6 is no simple till, but a keyboard-programmable, intelligent point-of-sale terminal. It has several modes of operation, a simple product file and a microcassette recording system all built-in. A number of such tills could easily be set up to record sales by product code during the day, and then linked, either directly or by telephone link to the central Pet system running Micro-Simplex. The interface program then transfers the data from the till at a staggering 9,600 baud and transfers the data on to the Pet disc. The data can subsequently be processed by the Micro-Simplex software, and linked in to the Anagram Stock Controller program as required.

The entire audit trail may be printed to satisfy both the VAT inspector and your accountant.

```
                              MICRO-SIMPLEX

                          RETURN OF VALUE ADDED TAX

                                SCHEME X

      MICRO-SIMPLEX LTD.                    REGISTRATION NUMBER : 1619991
      HARRISON BUILDINGS
      GREEN LANE
      WILMSLOW
      CHESHIRE  SK9 1LH


TAX DUE in this period on
     OUTPUTS (sales, etc) :                                    1  4000.15

     Tax due on imported goods, certain goods removed from
     bonded warehouses and certain services received from abroad :   2   300.20

     Underdeclarations of tax made on previous returns (except
     those notified in writing by Customs and Excise) :              3   400.00

          (Total of boxes 1,2 and 3)              TOTAL TAX DUE :    4  4700.35

TAX DEDUCTIBLE being the credit claimed in this period for
     input tax allowable (on purchases, etc) :                       5   325.10

     Overdeclarations of tax made on previous returns (except
     those notified in writing by Customs and Excise) :              6   200.50

          (Total of boxes 5 and 6)          TOTAL TAX DEDUCTIBLE :    7   525.60

                                NET TAX PAYABLE OR REPAYABLE
                          (Difference between boxes 4 and 7) :    8  4174.85

                              Value of outputs (sales,etc)
                          (excluding any Value Added Tax) :    9 4500.00

                             Value of inputs (purchases,etc)
                          (excluding any Value Added Tax) :   10 2000.00
```

Conclusions

- **The Micro-Simplex system is very easy to use. Its principles are well-proven under the existing manual system, and the hardware is tried and tested too.**
- **Expansion capabilities make growth of the system a practical possibility.**
- **Running on an 8000-series Pet system, the Micro-Simplex package including both hardware and software costs around £2,500. It is excellent value for money. The Norfrond Cash Register costs £1,500 and the interface to the Pet £500. Each of the four additional modules mentioned earlier cost £50, and the Anagram Stock Controller is £399.**
- **Micro-Simplex is at 8 Charlotte Street West, Macclesfield, Cheshire SK11 6EF. Telephone (0625) 615000, contact Mike Dawson.**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ZX Spectrum
BLUE EDIT
RED CAPS LOCK
MAGENTA TRUE VIDEO
GREEN INV. VIDEO
CYAN
YELLOW
WHITE
GRAPHICS
BLACK DELETE
1 ! DEF FN
2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 (POINT
9) CAT
0 _ FORMAT
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
Q ⇐ PLOT ASN
W <> DRAW ACS
E >= REM ATN
R < RUN VERIFY
T > RAND MERGE
Y AND RETURN [
U OR IF]
I AT INPUT IN
O ; POKE OUT
P " PRINT ©
READ RESTORE DATA SGN ABS SQR VAL LEN USR
A STOP NEW ~
S NOT SAVE |
D STEP DIM \
F TO FOR {
G THEN GOTO }
H ↑ GOSUB CIRCLE
J − LOAD VAL $
K + LIST SCREEN $
L = LET ATTR
ENTER
LN EXP LPRINT LLIST BIN IN KEY$ PI
CAPS SHIFT
Z : COPY BEEP
X £ CLEAR INK
C ? CONT PAPER
V / CLS FLASH
B * BORDER BRIGHT
N , NEXT OVER
M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power–personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um

X Spectrum software on assettes – available now

The first 21 software cassettes are w available directly from Sinclair. oduced by ICL and Psion, subjects clude games, education, and business/ usehold management. Galactic vasion... Flight Simulation... Chess... story... Inventions... VU-CALC... VU-3D 47 programs in all. There's something r everyone, and they all make full use the Spectrum's colour, sound and aphics capabilities. You'll receive a tailed catalogue with your Spectrum.

S232/network terface board

This interface, available later this ar, will enable you to connect your Spectrum to a whole host of printers, rminals and other computers.

The potential is enormous. And the tonishingly low price of only £20 is ssible only because the operating stems are already designed into the OM.

sinclair

nclair Research Ltd, Stanhope Road, amberley, Surrey GU15 3PS.
l: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

PRC812

FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.

Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive–or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY. ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

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ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

● Circle No. 153

Wordcraft 20 — word processing for the Vic. Jack Schofield investigates this plug-in ROM cartridge from Audiogenic.

Vic-20 Wordcraft

THE VIC-20 home and games colour computer is in the fiercely competitive market for machines costing less than £200. Its main limitations are well known — a narrow screen width of only 23 characters and a limited amount of user RAM — but the Vic-20 has several advantages over its rivals.

The Vic has quite a reasonable keyboard with typewriter-style keys, and it is actually available in the shops along with such important accessories as a cassette recorder, the Vic-1540 5.25in floppy-disc drive and the Vic-1515 dot-matrix printer. Moreover, several word-processing packages are now becoming available for the Vic-20. Wordcraft — which has been available for some time for larger versions of the Pet — has now been produced in a plug-in ROM version for the Vic-20.

Setting up is quite simple with Wordcraft 20. All you need to do is plug the cartridge in to the slot in the back of the machine, having first made sure that the power is switched off. Unlike the Atari, the Vic has no interlocking lid to ensure that cartridges are not inserted with the power on.

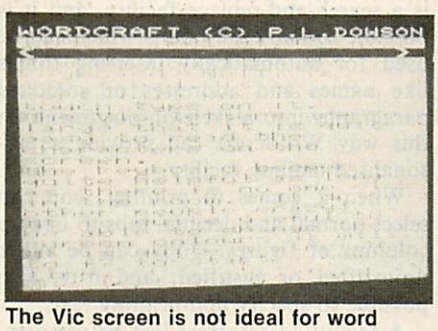
Default settings

Powering-up presents the title page of the program which lists default settings: printer type, Vic printer; line feed, auto; form-feed, no; stationery, continuous; storage, tape; and return to Basic, expanded. It also presents the commands for the four unshifted function keys: start Wordcraft, return to Basic, change value and next value.

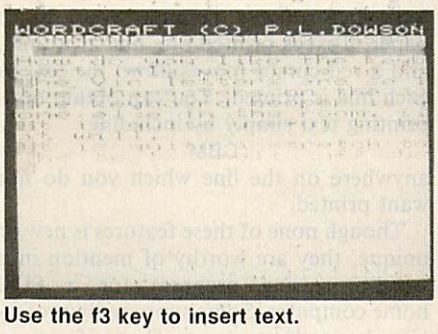
Pressing function key f5, change value, causes the cursor to step through the choices, which can then be altered using f7. The changing-value procedure is tedious, however, and must be followed every time that Wordcraft 20 is used.

Pressing f3 for return to Basic switches into the Vic-20's normal mode but with 11,775 bytes free. As well as 4K of ROM for storing the program, the Wordcraft 20 cartridge contains 8K which becomes available to Basic as free user RAM. You can return to Wordcraft by simultaneously pressing the Run/Stop and Restore keys — though the Wordcraft manual says that you only have to key Restore.

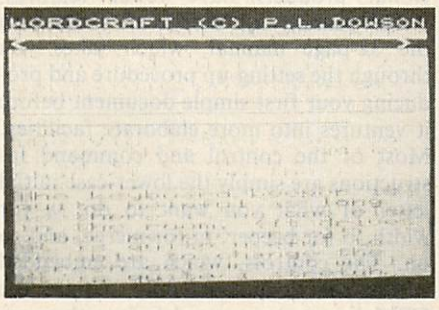
Fortunately it is not necessary to return to the opening screen to save a text on to either tape or disc since you can choose between them by issuing a command from inside the program itself. Pressing f1 sends you into the command mode where most of the screen is blank, but there is a command line and a flashing red cursor at



The Vic screen is not ideal for word processing.



Use the f3 key to insert text.



the beginning of a horizontal blue line.

The text surround is a sickly green, though it is quite a simple matter to change the screen colours. Pressing Ctrl-1 changes all the colours to their complementaries — which in this case looks even more hideous. Controls 2 to 7 increment the colours; holding down the keys gives a slow repeat so you can select the ones you want. Ctrl-2 controls the background, Ctrl-3 the text area, Ctrl-4 the command input line and line 2, Ctrl-5 the control indicator, Ctrl-6 the border and ruler, and Ctrl-7 the text characters. After you have made a mess of the colour scheme, pressing Ctrl-8 usefully resets all the colours to their original values.

The command line contains a number of useful registers, including P which tells you which page you are on, and numbers for the cursor position to tell you which line and column you are on. The last number gives you the amount of unused memory — in fact the number of characters still available. You seem to start with 6,220 and must obviously save your document when the value falls much below the 200-character mark. An error message is produced when it reaches zero. The Wordcraft 20 screen contains 25 lines of 24 characters — it is slightly larger than the normal Vic-20 screen — though only the bottom 22 lines are used for entering and editing text.

The first command you have to enter is W,23 to set the width of the screen. The maximum document width is 99 characters, but Wordcraft 20 initially assumes you are using 75-character lines, the appropriate width for A4 paper. If you enter text at this width, the text scrolls to the left when you reach the edge of the screen. Nevertheless it is probably best to set the screen width to 23 characters: the scrolling otherwise makes text entry very confusing. After all the text has been entered it can easily be reformatted for printing.

After setting the width of the screen window you press the Run/Stop key to leave Command mode upon which the number of characters free promptly leaps to 7,239. As you type in your document, Wordcraft 20 automatically takes care of line endings — which is, after all, one of the joys of word processing. Errors can be corrected by using the Del key, and arrowed cursor controls allow you to move around the screen to correct those you have missed.

Inserting text

To insert extra text you position the cursor where you want to make the insertion and press the f3 key. Three ruled lines of space appear for you to add your extra material. Pressing the f4 key then removes any remaining lines and closes up the text around the insertion.

Once you have completed your document, simply press the Run/Stop key again to return to the Command mode from where you can save it to tape or disc or print it out. If you issue a command such as "n" for new, which will clear the current text from memory, then Wordcraft gives a

NOT SAVED—PRESS STOP

message above the command line. Pressing Stop restores the status quo, or you can press the space bar to wipe out the text.

A document can be saved by typing in

s, name

where "name" is an alphanumeric identifier up to 12 characters long. The same document can be loaded using the command

g, name

(continued on next page)

(continued from previous page)
using the same same name, where "g" stands for get.

To print the document use command P, and press the space bar to start printing. Wordcraft prints one page at a time on to hand-fed stationery and pauses at the end of each page; you press the space bar to continue printing.

The page length is set by entering the letter "l" and the number of lines; Wordcraft defaults to 55 lines for A4 paper. From the Command mode you can instruct Wordcraft to print more than one copy of a document, and you can also send ASCII values direct to the printer, making it possible to format a non-Vic printer to use special character founts, etc.

When entering text the Vic issues a blip through the TV loudspeaker, varying the tone slightly for different letters so that fast typing produces quite an entertaining sound, though not one likely to be enjoyed by anyone else in the room. The beeper can be turned off by typing "b" in Command mode.

Memory economy

Another useful point is that you can call up the disc directory simply by typing $ in the Command mode without leaving Wordcraft or losing your text. Obviously documents are saved on disc or tape under the names you have given them. In addition it is possible to validate a disc to "tidy up" any areas of unused space and make the maximum number of bytes available for storage. This process takes several minutes.

It is even possible to have your text files written to tape or disc in encrypted form so that no other Wordcraft 20 user will be able to read them without knowing your keyboard. This is done by first issuing the command

e, keyword

but as the manual points out, it is your responsibility to remember your own keywords.

With Wordcraft, the Vic-20 becomes more than just an electric typewriter, thanks to numerous commands for text entry, printing and mailing. On entering text it is possible to insert, delete and move blocks of text. You can insert "soft" hyphens, which will only be printed if Wordcraft has to split the word in which it appears across two lines. There is a search-and-replace facility, and it is possible to mark fill points which can be used for automatically inserting things like names and addresses or standard paragraphs into a skeleton document. In this way Wordcraft can provide a personalised mailing facility.

When it comes to printing, you can select normal and decimal tabs to line up columns of figures. Copy can be either unjustified or justified, and it is also possible to specify non-printing text.

A facility to reformat text before printing allows you to see how the text will look before you commit yourself to paper. Text is printed one line at a time, and a red cursor moves down the text as each line is printed. You can obtain non-printing text simply by including

CBM

anywhere on the line which you do not want printed.

Though none of these features is new or unique, they are worthy of mention in a word-processing program for a £170 home computer. Some supposedly professional products have fewer features.

The usability of Wordcraft starts with the 32-page manual, which takes you through the setting-up procedure and producing your first simple document before it ventures into more elaborate facilities. Most of the control and command instructions are simply the lower-case initial letter of what you want to do: w for width, b for beeper, m for merge, and so on. The controls, which are embedded within the document, only require the CBM key to be pressed before they are entered, and are similarly memorable: t for tab, s for search, and so on. This feature makes Wordcraft very easy to learn to use.

Both error checking and crash-proofing are good. Accidentally entering a stupid command usually produces a series of beeps to attract your attention and the message

ERROR — CODE IGNORED

The program does not dump you back into Basic, and your text is very well protected.

Wordcraft uses the four special-function keys to provide eight of the most often used commands, though their use is optional. In all cases alphabetic commands can be used instead since Wordcraft was originally written for Pets without function keys. On the review sample pressing Return failed to give a new line, as the manual says it should, which meant using the optional function key f7, which is a bit of a stretch from the keyboard.

Conclusions

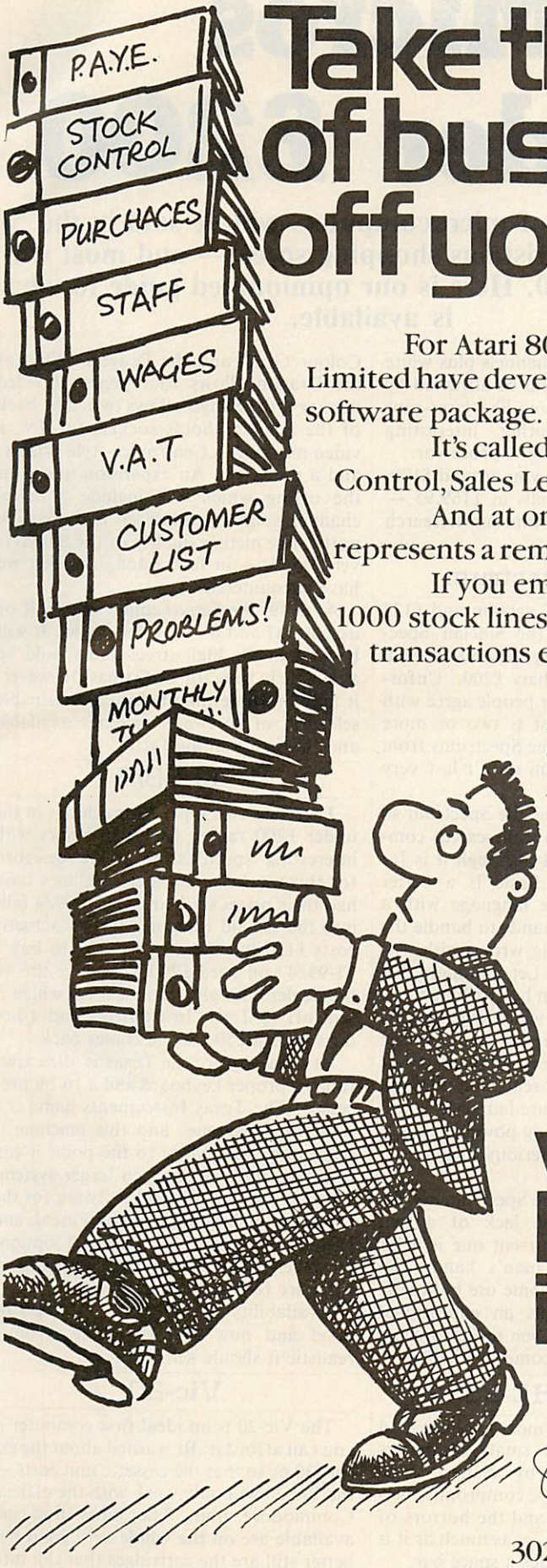
- **Vic owners who do enough writing to justify spending £125, VAT included, on a word-processing program should be satisfied with Wordcraft.**
- **Most of Wordcraft's limitations result from those of the Vic-20 itself. The Vic's characters, while large, are not attractive and not very legible. For example, it is easy to confuse the "c" and "o" characters, and the lines are too close together. While an 80-character line is best for word processing and 40 characters will do, 23 characters per line is too few, even with scrolling.**
- **Wordcraft does not offer spelling checking, maths, or concurrent printing which would enable you to continue entering text while something else is being printed.**
- **Wordcraft offers enough facilities to be suitable for use by a small business or a writer, as well as taking care of home word-processing requirements. This is a commendable achievement for a package running on a £170 micro.**
- **Wordcraft is available from Vic dealers, or from Audiogenic, PO Box 88, Reading, Berkshire.**

Wordcraft Commands.

a.values — send ASCII values to printer
b — beep on or off
c — change storage device to cassette
d,drivenumber — change storage device to disc drive number optional
e,keyword — encrypt output using keyword
f,name,pages — fill from file "name" using specified pages
g.name — load file named "name"
j,y or j,n — justification yes or no
l,nn — set page length
m,name,pages — merge from file "name" using specified pages
n — start a new document
p,pages,type,copies — print copies of pages specified, bold or underlined
r,name — replace file "name" with current text
s,name — save current text as file "name"
v,drivenumber — validate disc, drive number optional
w,nn — set page width
$ — examine disc directory
$,end — end Wordcraft session
",nn,type — set physical page length and stationery type

Wordcraft Controls.

c — examine controls on a line
d(F1) — delete word under cursor
e — erase block
m — move block
n — cancel control
p — move from one page to another
r — reproduce block
s — search
t(F5) — normal tab
z — exchange all strings found for new string specified
(— start highlighting
) — end highlighting
[— start indent
] — end indent
— enter rule
(full stop) (F6) — decimal tab
+ — skip
Return (F7) — start new line
Del (F2) — Delete line from cursor
Inst (F3) — open up insert space
Home (F8) — start new page



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Micros under £200

Thousands of microcomputers will be sold in the annual pre-Christmas shopping spree — and most will cost under £200. Here is our opinionated guide to what is available.

COMPUTERS WERE, not long ago, things that only governments and multinational corporations could afford. Now they are available to anyone, with numerous machines costing less than £200.

But which one should I buy?

Naturally there is no clear answer. You tend to get what you pay for but there are several main machines to consider. Bear in mind that hardware without software is almost useless — especially to a beginner. It is important to consider the consequences of buying one of the newer machines which lacks software support and for which peripherals may not be available. If possible include £100-worth of software in your system price.

Sinclair ZX-81

The ZX-81 is the Ford Model T of the home computer world. Over half a million machines have been sold worldwide; how many end up as paper-weights in anybody's guess. Although these micros can be bought new for a mere £50 their second-hand price is even lower and there are some real bargains to be had.

The strength of the ZX-81 is its enormous popularity. It has ensured that a large amount of software is available and there is also a wide range of add-on hardware. Despite the limitations of the machine — they are many — a lot of very imaginative uses have been made of the ZX-81. The machine has only 1K of memory, but expansion to 16K is both cheap and easy.

The computer is a masterpiece of technical achievement and a tribute to high-volume marketing, but is clumsy and difficult to use. Its keyboard is tactile, tacky would be a better word. Basic keywords are entered by single key strokes, a method not used elsewhere and which does not help you become keyboard-literate. The Basic language used is somewhat primitive.

If you are new to computing spending £30 on a second-hand ZX-81 is the best possible low-cost introduction — it's not so much to lose. A lot can be done to expand the computer into a system but your money would be better spent buying a different machine.

Oric

Named after the comuputer in the BBC science-fiction series *Blake's Seven,* the Oric is at the moment the only colour computer on the market for less than £100. It is doubtful that it will be available in any quantity before Christmas, but eventually it will be sold through both the now commonplace high-street microcomputer outlets and the more traditional mail-order channels.

Although the Oric is aimed exclusively at games players and the non-expert user, it bewilderingly lacks a games port. It comes from the same design-stable as the Tangerine computers.

The sound capabilities of the Oric are good: there are three channels plus white noise. Games players will be attracted by pre-programmed features like laser-zaps and explosions. Another interesting feature is the optional 6809 processor.

A 16K Oric will cost you around £100, and the 48K version sells at £169.95 — prices that might give Sinclair Research some headaches.

Sinclair Spectrum

At £125 for the 16K version and £175 for the 48K machine the Sinclair Spectrum represents possibly the best value in computing for less than £200. Unfortunately, so many other people agree with us that the waiting list is two or more months long. Also, some Spectrums from the first production run didn't last very long.

What is it that makes the Spectrum so popular? First, it is to some extent compatible with the ZX-81 although it is far more powerful. The Basic is a better implementation of the language with a number of extra commands to handle the graphics: the only thing wrong with it is the enforced use of the Let command. Second, its popularity can be attributed to a steamroller effect — a wide range of software has already been written for the machine, and therefore more people want to buy it. Third, it is a real computer and when the Microdrives are launched it will have real data processing power. There is even some very good serious software in the offing.

The drawbacks of the Spectrum are the delivery time and the lack of a real keyboard, using the current one is a bit like shaking a dead man's hand. The Spectrum is ideal for home use but really comes into its own as an educational machine, and will be even more so when the Logo language becomes available.

Sanyo PHC-25

The PHC-25 is the most sophisticated of a range of three small computers recently introduced by Sanyo. The keyboard is a reasonable compromise between a real keyboard and the horrors of the Sinclair keyboards, in as much as it is qwerty-type and includes a space bar.

Basic on the Sanyo reminds us of the Colour Genie and the Dragon. Whereas the Dragon allows four pages of video memory, the Sanyo allows two. The back of the machine holds sockets for TV, a video monitor, a Centronics-style printer, and a user port. An expansion unit is in the offing which will include a three-channel sound synthesiser and joystick ports. The picture quality of the Sanyo is very good — in fact among the best we have encountered.

At £149, the Sanyo comes with 16K of user RAM and 6K of video RAM. It will be sold in the high street and should be available in time for Christmas. However, it may be some time before a reasonable selection of software becomes available and this is a limiting factor.

TI-99/4

There are two types of machines in the under £200 range. New computers with interesting specifications were designed for this market and older machines have had their prices slashed. The TI-99/4 falls into the second category. It now actually costs £150 but there is a catch, to buy a TI-99/4 you need £200. You give this to the dealer who gives you a form which is sent off to Texas Instruments and a few days later a £50 cheque comes back.

At its new price the Texas is attractive. It has a proper keyboard and a 16-bit processor. The Texas Instruments name is a well respected one, and this machine is quite powerful. More to the point it can form the basis of a much larger system. There is a range of good software for the computer including Logo and Pascal, and speech synthesis is a standard option. However, there is not much independent software for the machine.

Availability of the TI-99/4 should be good and now that the price is more realistic it should sell.

Vic-20

The Vic-20 is an ideal first computer if you can afford it. Be warned about the extra £30 or so that the cassette unit costs — the Vic-20 will only work with the official Commodore unit. The tapes that are available are on the whole very good but better still are the cartridges that slot into the back of the machine. Not only is there

a range from Commodore but other suppliers as well.

Joysticks, paddles, light-pens, disc drives and printers are all available now as are a large number of other add-ons. The machine is well made and has a proper keyboard making it just about usable for serious applications such as word or data processing. The version of Basic is compatible with the well known Pet Basic and some programs are interchangeable, though of course the Vic offers only a limited number of characters per screen.

The Vic only has 3.5K of user RAM in the basic model but this can be expanded via the user port. Unfortunately, such expansion is not cheap. A cartridge can also be purchased with extended Basic commands to compensate for the limitations of Pet Basic.

The Vic is a very good machine though it is better for entertainment than anything else. The Space Invaders and Pacman cartridges are particularly good but of course they are not actually called by those names.

Buying a Vic should not pose any problems; there are plenty of them about. Expect to pay around £170 though if you shop around you might find one cheaper.

Colour Genie EG-2000

The Colour Genie is a reasonable microcomputer not a remarkable one. It has more or less everything a micro in its range should have in more or less the right quantities. If this seems to damn it with faint praise, unfortunately there is no single feature on this machine which is outstanding and nothing which is particularly bad, it's just ordinary. In appearance it is like the Vic-20, with a real keyboard and a row of function keys. Its software is reminiscent of Tandy Level II Basic, the language used by the earlier Genies.

Its best feature is the Extended Colour Basic mentioned above. It has commands for just about everything including handling the graphics and sound. Programmers will like this machine and its powerful editing facilities which include the Auto command and full trace facilities. The tape operation looks remarkably like that of the Tandy with the twin flickering stars in the corner. There are enough ports around the edge of the Genie for most purposes.

The worst feature of the Colour Genie is the rather sad colour. Red is really orange and colour graphics tend to be dominated by autumnal colours. But as an alternative to a Dragon the Genie is fine.

Dragon 32

The Dragon 32 is the first computer to be manufactured by a toy company but that does not make it anything less than a real computer. It comes in a sturdy case which could have been smaller and a little sturdier but will do nicely for most purposes. It has a proper keyboard which is very tough and will take the kind of battering expected of a typewriter, but it lacks lower-case letters — which is ridiculous in 1982.

The Dragon is faster than most of the other micros in this under £200 range. There are a number of useful commands to make full use of the high-resolution colour graphics; one special feature is that the video memory can be paged, that is, screens of information can be set up in memory and then rapidly switched allowing a form of animation not possible on many cheap machines. The colour is not particularly good in itself and only four colours can appear on the screen at any one time. The picture quality is excellent and the graphics command set make up for this. We especially liked the Draw function which allows the user to set up strings of drawing commands, and the facility for copying areas of the screen into arrays in the memory and out again. Sound on the Dragon is not as good as on a number of other micros, but once again the instructions for handling what sound there is are very good.

The Dragon is a good machine for the absolute beginner, but the manual is both difficult to use and patronising in tone, hopefully you'll never need to find anything. It is much easier to use the crib sheet of instructions which someone had thoughtfully included.

The Dragon is being sold in a large number of high street stores and availability is good, meaning that providing you have the cash, you can start programming immediately. If programming is not for you there is some software already available for the machine, plus the added bonus of being able to use at least some of the cartridges intended for the very similar Tandy Colour computer.

Atari 400

Though it was launched as far back as 1979 the Atari 400 remains the most sophisticated of the micros in this category. It has by far the best graphics capabilities thanks to the custom-designed chips which supplement the 6502. It can display up to 128 colours including shades, at once and the sound facilities are also excellent. But it is also the most expensive as the "under £200" price tag does not include the plug-in Basic language ROM and manuals, or the dedicated cassette recorder. These add almost £100 to the price.

The standard model comes with 16K of RAM, and the expansion to 32K means taking the machine back to the shop. You need the upgraded version for use with the Atari 810 disc drive and some of the extra languages such as Microsoft Basic on disc.

The keyboard is of the membrane type not moving keys but it is very high quality. It is eminently suitable for home use, especially by young children, though not for touch typing.

Atari is best known for arcade games and for the popular video games system. Many of the same games are available in plug-in ROM versions, and some games — Centipede and Missile Command — are as good as the arcade versions. There are also many excellent user-written programs distributed through the APX, Atari Program Exchange scheme.

In America the Atari is a best seller and this has lead to a huge amount of independent software appearing. Unfortunately most of this is rather expensive by the time it reaches the U.K.

There is some excellent educational software too, but it may be too American for most British tastes. Interesting exceptions are the language courses such as Conversational French which have been produced in conjunction with Thorn EMI and Longman in the U.K. These use the ability of the Atari 410 cassette recorder to record not only programs but also to output a voice track — under computer control — through the TV loudspeaker.

The Atari 400 has many advantages in being well made, well established and well supported, but you have to be willing to pay the price.

Users' groups

ICPUG/Independent Commodore Product User Group,
Mick Ryan,
164 Chesterfield Drive,
Riverhead,
Sevenoaks,
Kent TN13 2EH.

National ZX User Group,
17 Avenue Mansions,
Finchley Road,
London NW3 7AX.

Oric Owner Magazine,
Tangerine Computer Systems,
Cambridge Science Park,
Cambridge CB4 4BH.

TI Home,
157 Bishopford Road,
Morden,
Surrey.

In the chart on the next page we have tried to restrict entries to facilities available from Basic. For example, the Atari 400 can display 128 colours at once via machine code, but a maximum of 16 using the Setcolor command from Basic. With accessories and add-ons, only those available from the manufacturer are included. Athough some firms do not supply a printer or joysticks, these may be available from an independent maker. While few manufacturers make a disc drive, some are still working on this. It is up to you to make sure that the micro you choose will do all you want, hopefully this table will help.

	Sinclair ZX-81	Oric 1	Sinclair Spectrum	Sanyo PHC-25
MAIN PROCESSOR	Z-80A	6502A	Z-80A	Z-80A
RANDOM ACCESS MEMORY				
standard RAM	1K	16K	16K	24K
bytes free to Basic	700		9K	14K
maximum RAM	16K	64K	48K	—
KEYBOARD				
type	touch	moving key	moving key	moving key
number of keys	40	57	40	65
auto repeat	no	yes	yes	yes
function keys	no	no	no	4
SCREEN DISPLAY				
text display	24 × 32	40 × 28	32 × 24	32 × 16
maximum graphics resolution	64 × 44	240 × 200 plus 4 lines text	256 × 192	256 × 192
number of characters	128	128	132	256
user definable?	no	80	21	yes
maximum number of colours on screen at once	monochrome	8	8	9
SOUND FACILITIES				
keyboard sounder	no	yes, 3 tones	yes	no
sound generator: number of voices	no	3 voices plus noise channel	no	3
INPUT/OUTPUT PORTS				
ROM cartridge slot	no		no	no
games ports	no	no	no	no
RAM expansion slot	yes		no	not known
other	none	2 parallel 1 Modem	user port	Centronics parallel user port
LANGUAGES SUPPORTED				
Basic	in ROM	in ROM	in ROM	in ROM
Extended Basic	—	—	—	—
Assembler	tape	—	tape	—
Forth	tape	tape or disc	—	—
Pascal	—	—	—	—
Lisp	—	—	—	—
Pilot	—	—	—	—
Logo	—	—	under development	—
other	—	—	—	—
ACCESSORIES AVAILABLE FROM MANUFACTURER				
paddles/joysticks	no/no		no/no	no/yes
numberic keypad/light-pen	no/no		no/no	no/no
dedicated cassette recorder	not required	not required	not required	yes but standard
disc drive(s)	no	no	no	no
printer(s)	32-column ZX	no	32-column ZX	not known
SPECIFICATION AS SUPPLIED				
documentation	manual, programming manual	manual	manual, programming manual	manual
software included	no	not known	cassettes: 14 programs + Forth	no
dimensions (mm)	168 × 172 × 40	280 × 180 × 55	233 × 144 × 30	305 × 163 × 53.5
weight	345g.	about 1kg.	568g.	1.1kg.
country of manufacture	U.K.	U.K.	U.K.	Japan
distribution/availability	immediate	not known	mail order	not known
PRICES, INCLUDING VAT	£49.95	£99.95, 16K; £169, 48K	£125, 16K; £175, 48K	£149

TI-99/4A	Vic-20	Colour Genie EG-2000	Dragon 32	Atari 400
TMS-9900	6502	Z-80A	6809E	6502
16K	3.5K	16K	32K	16K
14.5K	3,583	14K		13,326
52K	25.5K	32K	64K	32K
typewriter	typewriter	typewriter	typewriter	touch
48	66	63	53	57
yes	yes	yes	no	yes
11	4	4	no	3 plus reset
32 × 24	22 × 23	40 × 25	32 × 16	40 × 24
256 × 192	168 × 176	160 × 96	256 × 192	320 × 192
94	255	256	95	128
128	128	128		yes
16	10	9	9	16
yes	no	no	no	yes
3	3	3	1	4
yes	yes	yes	yes	yes
one	yes	2	2	4
yes	yes	no	no	no
speech synthesis	serial port; 8-bit	2 parallel, 1 light-pen	Centronics	no
optional	user port			
in ROM	in ROM	—	—	plug-in ROM
plug-in ROM	disc	in ROM	in ROM	disc, 32K minimum
plug-in ROM	no	tape (6K)	—	plug-in ROM, 16K minimum
—	plug-in ROM	—	—	disc, 32K minimum
plug-in ROM	—	—	—	—
—	—	—	—	plug-in ROM 16K min
—	—	—	—	—
plug-in ROM	—	—	—	
—	—	—	—	macro assembler
				disc, 32K minimum
no/yes	yes/yes	no/yes	no/no	yes/yes
no/no	no/yes	no/no	no/no	yes/no
no	yes	no	yes but standard	yes
yes	yes, 170K	no	yes	yes, 88K
40-column or 80-column	80-column	no	no	40-column
manual	user manual, reference guide	introductory, Basic and technical manuals	manual	reference manual, training manual
no	no	demonstration tape	no	no
259 × 381 × 71	405 × 73 × 207	440 × 280 × 90	320 × 390 × 90	343 × 292 × 115
2.3kg.	1.5kg.	4kg.	2.1kg.	2.6kg.
Italy	West Germany	Hong Kong	U.K.	U.S.
immediate	immediate	immediate	immediate	immediate
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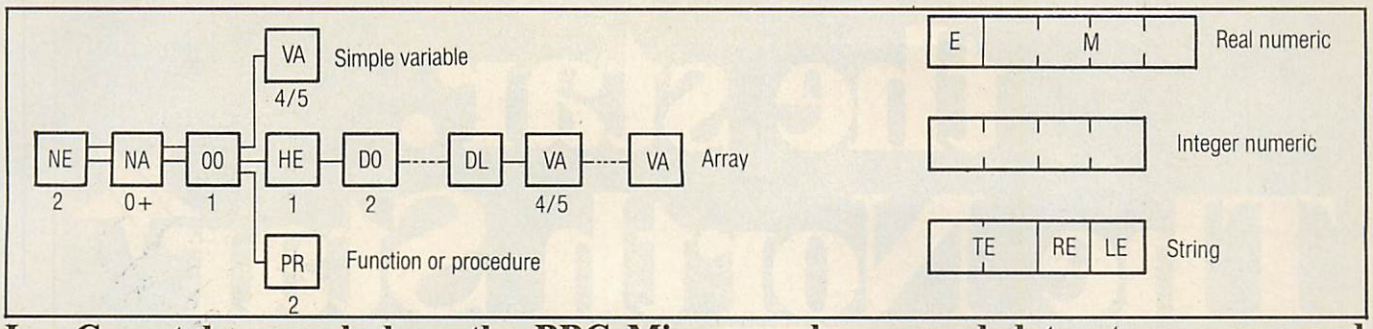

Ian Copestake reveals how the BBC Micro can be persuaded to store arrays and strings economically

BBC memory secrets

PROGRAMMERS QUICKLY LEARN to keep their appetite for memory under control, but the BBC Micro shows no such restraint. Its normal method of storing programs and variables can occupy large quantities of RAM with very little to show for it. Yet careful programming, based on an understanding of the way the micro uses memory, can help thwart these wasteful habits.

The address of the first program byte is given by page. Its value can be changed by the user, but is normally &0E00. Each program line consists of four bytes, followed by the text of the line. The four bytes are:

&0D
High byte of line number
Low byte of line number
Length of line

The length of the line includes these four bytes.

The last program line is followed by &0D, &FF, and these two bytes are present even when there is no program. Thus the value of the variable Top, which points to the byte after the &FF, is always at least two more than the value of Page. Lomem, which is normally the same as Top, marks the first byte of the variables store. Locations &0002,03 give the low and high bytes of the address, which I will call Vartop, of the next free byte in the store.

The variables can be divided into three categories:

- Simple variables
- Arrays
- Functions and procedures

Figure 1 shows, in a modular fashion, the structure of each category when stored in the memory. The number under the module shows how many bytes it occupies.

The two locations of the NE or Next module give the low and high bytes of the address of either the next variable whose name begins with the same character, or the next function or procedure whatever tis name begins with. The high byte is reset to zero if there is no such next variable.

The NA or name module of zero or more bytes is made up of the ASCII code for:

the first letter of the name, only if it is a function or a procedure, plus
the rest of the name, if any, plus
% if it is an integer numeric variable, plus
$ if it is a string variable, plus
(if it is an array.

Thus the first letter of the name of a simple variable or array is not stored here. A real floating-point variable called A will have no NA module at all.

The one-byte 00 or Zero module simply contains the value zero.

The VA or Value module is four or five bytes long. There are three possible forms of this module, as shown in figure 2. In the Real Numeric form the exponent byte is followed by four mantissa bytes. Bit 7 of the first mantissa byte gives the sign of the number. The Integer Numeric form is four bytes long, the first being the least significant. In the String form TE gives the low and high bytes of the address where the text of the string is stored. When a simple string variable is first created, the text will follow the VA module though it may not stay there for long. RE is the number of bytes reserved for the text of the string. LE is the current length of that text, and may be less than RE.

In an array, the form of the VA module depends on the form of the array. If the array has 50 elements, 50 VA modules will be stored right from the start though no actual text space is reserved for a string array by the Dim statement. All the REs and LEs start at zero. The element numbers of the VA modules in an array run in the order (0,0) (0,1) ... (1,0), and so on.

The single-byte HE or Header module indicates the number of bytes in an array header, measured from HE itself to DL, inclusive. Looked at another way, the value of HE is one more than twice the number of dimensions in the array. Since HE is a single byte, you can declare an array with up to 127 dimensions if you are feeling really keen.

There is a pair of bytes for each dimension in the array: modules D0 to DL correspond to the zeroth dimension. Each pair gives the number of elements in the corresponding dimension, the first byte of the pair being the less significant. For example, after

```
DIM A$(1,1):
```

D0 will be &02, &00; D1 will be &02, &00; HE will be &05.

These two locations of the PR Program module contain the low and high bytes of the address, within the program itself, where the function or procedure is defined. They point to the program byte immediately following the name of the function or procedure.

The PR bytes are followed by the formal parameters, if there are any, and if their names have not been used earlier in the program — in which case they would already exist in the variables store. These in turn are followed by any local or other variables created within the function or procedure. Each of these parameters or variables is stored with the usual four modules for a simple variable: NE NA 00 VA. As far as the variables store is concerned, the statement

```
LOCAL A
```

has the same effect as

```
LET A=0
```

Variables within a function or procedure are not transferred to the store until the function or procedure is actually called.

Data is transferred to the store when it is Read. From our point of view the program

```
10 DATA yes
20 READ Y$
```

is, when run, the same as

```
10 Y$ = "Yes"
```

The BBC Micro has a voracious appetite for RAM when storing the text of a string. Run this program:

```
10 LET A$="GLUTTONY"
20 LET A$=A$+A$
30 PRINT LEN A$
40 GOTO 20
```

The program stops when the length of A$ has doubled up to 128, because the maximum length for a string is 255. At this point the computer has now consumed no less than 272 bytes of variables storage space. You can check this by looking at Top and Vartop, and substracting one from the other.

(continued on page 87)

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(continued from page 85)

To see how it does this, type Clear, then

A$ = "YES"

as direct commands. You have now used 11 bytes: two for NE, one for the $ in NA, one for 00, two for TE, one each for RE and LE, and three for the text itself. If you now type

A$ = "NO"

the text will be overwritten to produce "NOS". The value of LE is changed from 3 to 2, so that the computer ignores the final S. Nothing else changes.

Now type

A$ = PERHAPS"

It will not fit into the three bytes reserved by RE; so the value of RE is altered to 7, and the value of LE also changes to 7. But the computer is not clever enough to use the space occupied by "NOS" even though A$ is the only variable in the store. It has to start again at the next free byte, given by Vartop: the address of the text, as stored in TE, is therefore increased by 3.

Your seven-character string now uses 18 bytes of memory, of which three are permanently dead. If you had started with

A$ = "YES[4SPC]"

you would now be using only 15 bytes to store "PERHAPS".

But this is not the whole story. Suppose you carry out

```
CLEAR
A$ = "YES"
A$ = "UNLIKELY"
```

How many bytes are you using now, for an eight-character string? Not 16, not even 19 — but 27. Two for NE, one for NA, one for 00, two for TE, two for RE and LE, three for the dead "YES", eight for "UNLIKELY" and — if you can believe it — eight spare ones which the machine has thoughtfully set aside in view of your inept programming. So while the value of LE is 8, that of RE has now risen to 16.

Every time you try to assign eight or more bytes of text to a string variable whose RE is insufficient, you get eight bytes more than you asked for. The effect is cumulative, and operates right from the start; so that

```
CLEAR
A$ = "1234567"
```

reserves seven bytes of text space, but

```
CLEAR
A$ = "124345678"
```

reserves 16 bytes.

The moral is: when you first assign a string, give it the maximum length it is ever likely to need.

Careless typing costs bytes, too. If you type A$ = 1 when you mean A% = 1, you will set up a string variable called A$. The command

DIM A(6000)

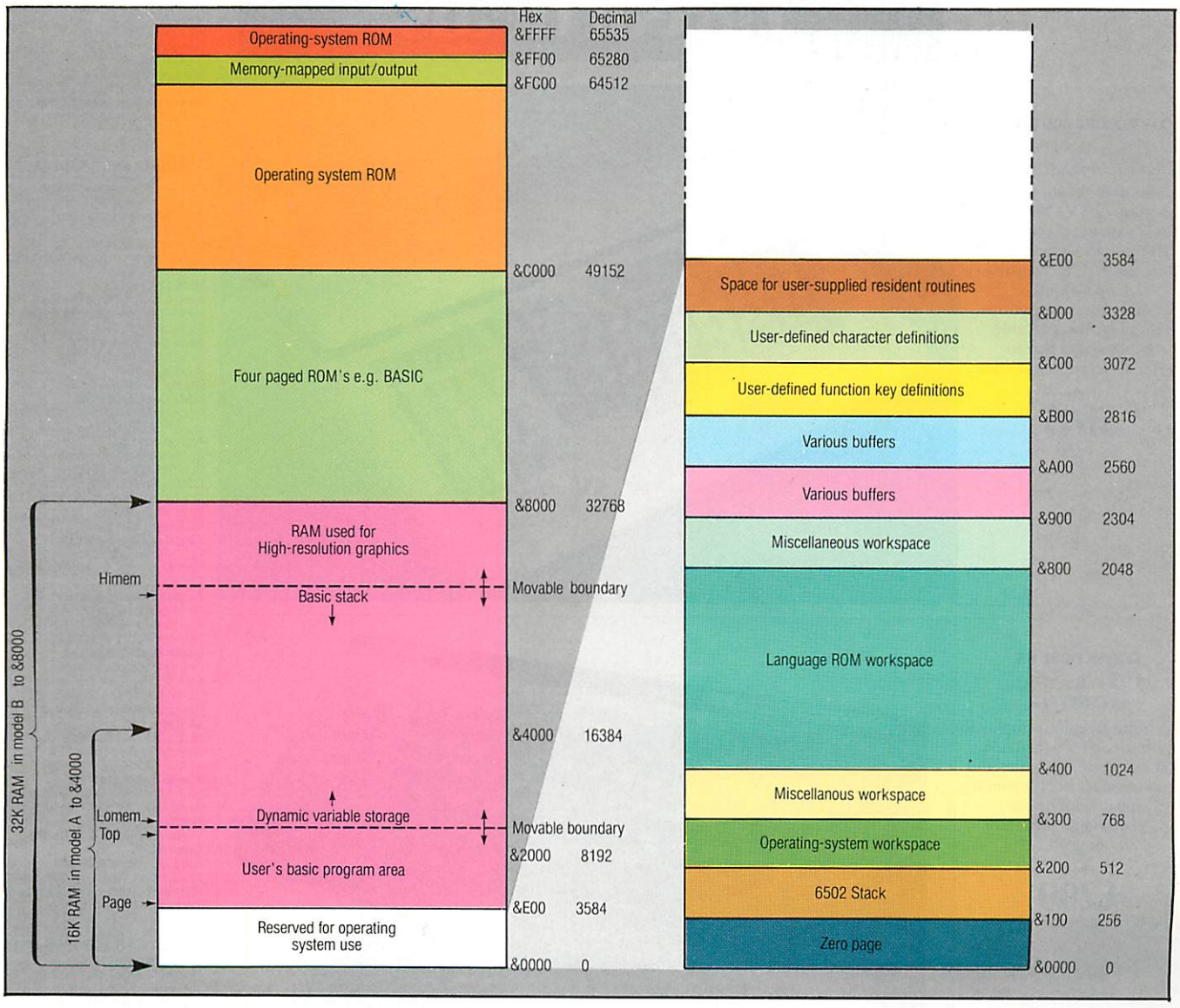
will produce the error message "Dim space", because it is too big. But the NE, NA, and 00 modules will have been set up, so if you follow on with

DIM A(1)

you will get a "Bad Dim" message, because you are not allowed to redimension an existing array.

The operating system needs to know where it has stored each variable, and keeps a catalogue in page &04 of the memory for this purpose. Locations &0482,83 point to the first variable whose name begins with A; &0484,85 indicate the first whose name starts with B; &04C2,C3 point to the first whose name begins with "a" and so on. Locations &04F6,F7 point to the first function and

(continued on page 91)



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(continued from page 87)

&04F8,F9 to the first procedure. Now you can see why the first letter of the name of a simple or array variable need not be entered in the variables store.

All clear

The catalogue is destroyed when a program listing is modified, even if the length of the program is unchanged. So even the most minor adjustment has the effect of Clearing all variables except the system integers.

The system integer variables are stored near the catalogue, taking four bytes each. @% starts at &0400, A% at &0404, and so on up to Z% at &0468. The value of @% is set initially to &0A0A while P% to Z% contain zero. Curiously enough A% to O% have the value &FFFFFFFF, corresponding to −1 — at least they do on my machine. The system integers do not appear in the main variables store at all.

The definitions of the user-defined function keys are stored in page &0B of the memory. The 18 locations &0B00 to &0B11 give the addresses, offset from &0B01, of the definitions for keys 0 to 17 — even though there are only 10 functions keys on the keyboard. In other words, the definition for key f4 starts at &0B01 + ? (&0B04). Initially, all the above locations contail &11.

The statement

```
*KEY 0 RUN ¦ M
```

will, assuming this is the first key to be defined, put the ASCII codes for the letters R U N into locations &0B12,13,14, and &0D into &0B15. The code &0D stands for carriage return, the equivalent of Ctrl-M.

Locations &0B01 to &0B11 — that is, all except the one for key f0 — are now set to &15. The next definition will begin at &0B16, and so on.

When a key is redefined, the new code is first tacked on the end, after all the other key definitions. Then the original definition is deleted by shifting everything that follows it backwards. So if you want to reprogram a key and are short of function-key memory, start by resetting it to contain nothing.

Function keys

Some interesting effects can be obtained with the function keys. Try this, starting with all keys undefined:

```
*KEY0HELLO,[SPC]
*KEY1HOW ARE YOU?¦M
PRINT $&B12
```

Though the space after "HELLO," is reproduced, spaces before it would be ignored.

If you have an Epson MX-80 printer, you may have found that the Delete key does not communicate with it; typing

```
RUU Delete N
```

produces "RUN" on the screen but "RUUN" on the paper. Now you can in fact solve this by typing

```
RUU Delete Control A Delete N
```

since Ctrl-A causes the next character to be sent to the printer only.

But there is a much better way. Starting with all keys empty, type the following:

```
*KEY0 ¦A ¦A ¦A
&B12 = 127
&B14 = 127
```

This key now Deletes on the screen and the printer at the same time. You can even delete the command mode prompt from the printer buffer, though not from the screen. All this routine does is to overwrite two of the As with 127, which is the ASCII code for Delete.

You can treat the Break key as function key f10. It will still cause a break, but will then carry out whatever instructions you have put into it, such as Old:M. Incidentally, if you are thinking of using page &0B as a chunk of extra RAM, you will have to be very careful not to redefine the Break key by accident.

Versions of the computer from issue 1.0 will apparently allow the user to reprogram the cursor control and Copy keys. It may even be possible on issue 0.10 because

```
*KEY15 PRINT "HELLO" :M
```

puts all the right code in memory page &0B; and *FX4,2, which is supposed to enable this programming, certainly disables the editing keys. This possibility would account for 16 keys, and it may be that location &0B11 only exists to mark the end of the definitions list.

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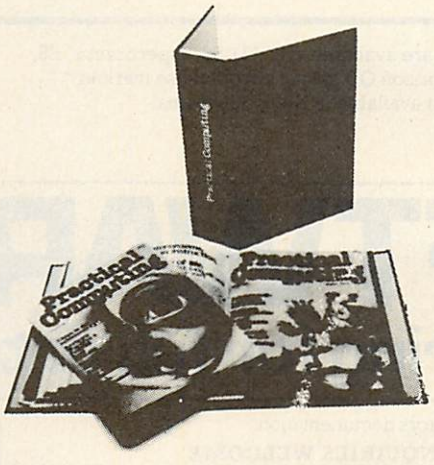

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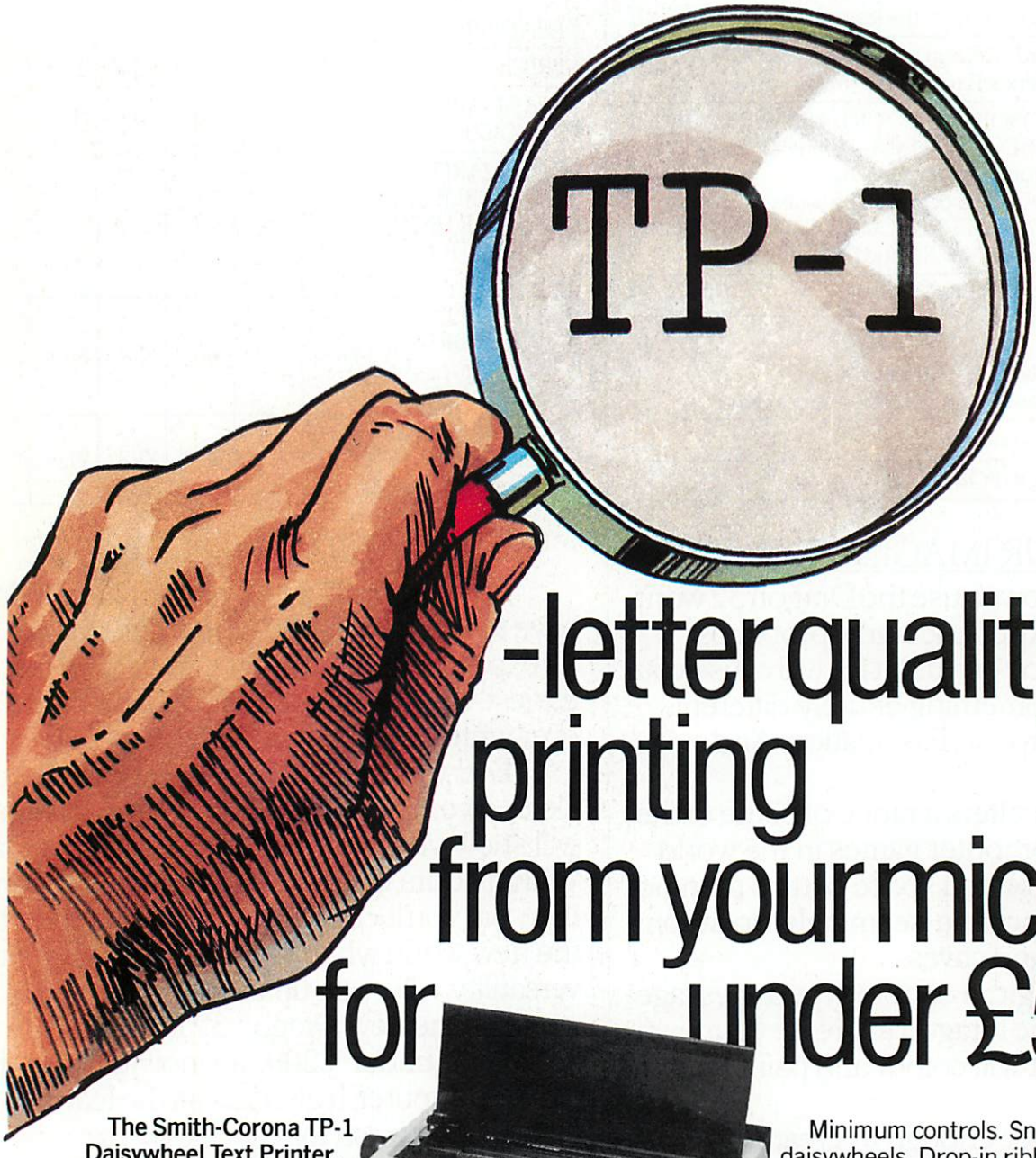

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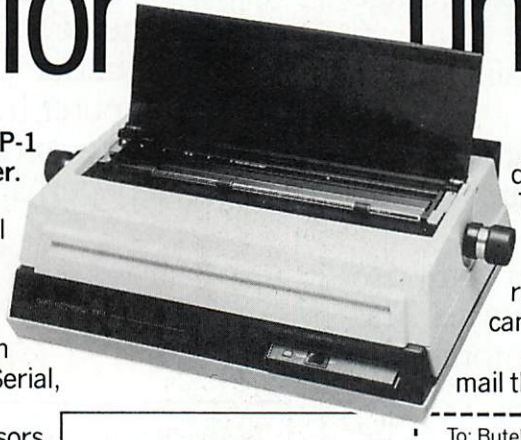

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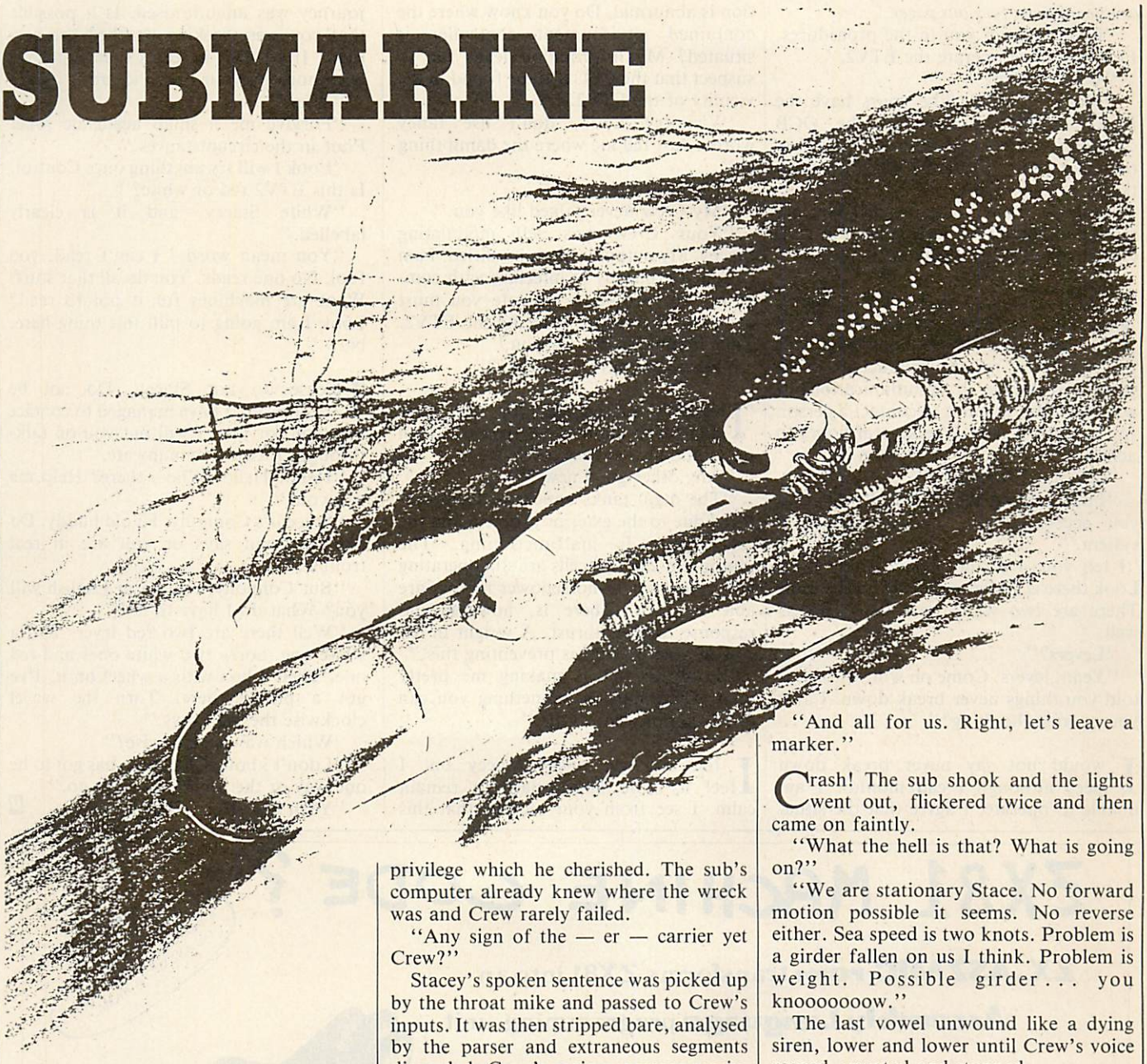

The tiny one-man submarine sniffed its way across the sea bed, 1,500 feet down on Blake Plateau in the Bahamas. Its lights were no match for the swirling mud and Stacey could see no further than a few feet through the murk. At his spoken command the submarine obediently altered course. The wreck that he searched for was somewhere in the area and would certainly be found eventually.

The Crew Model III computer that actually ran the craft was not so short-sighted. Its precision fathometers, sonar and infra-red sensors scanned the surroundings at many different frequencies providing a constantly updated map of a half-mile radius around the sub.

The controls were under Crew's auto-protection. No adjustment passed its censoring system if safety was at risk. Being a Grade 2 Salvageman Stacey was occasionally entitled to command a sub with AMO Apparent Manual Override, a privilege which he cherished. The sub's computer already knew where the wreck was and Crew rarely failed.

"Any sign of the — er — carrier yet Crew?"

Stacey's spoken sentence was picked up by the throat mike and passed to Crew's inputs. It was then stripped bare, analysed by the parser and extraneous segments discarded. Crew's main processor received the cleaned message and responded.

"Nine degrees to starboard, Stace. About — er — 200 metres."

Crew's output was carefully modelled on Stacey's own speech patterns.

by David Haynes

It made a man feel more at home. Stacey was permitted to swing the sub over and they homed in.

"Any info yet Crew?"

"Well Stace pretty steady, you know. Here we are. Coming up now."

They arrived over a tangle of girders. The lights picked out a steel structure with barnacles as they cruised over the wreck of the manganese dioxide carrier.

"Say — er — Crew. How big was this one?"

"Three units of 22½ tons I should think Stace."

"And all for us. Right, let's leave a marker."

Crash! The sub shook and the lights went out, flickered twice and then came on faintly.

"What the hell is that? What is going on?"

"We are stationary Stace. No forward motion possible it seems. No reverse either. Sea speed is two knots. Problem is a girder fallen on us I think. Problem is weight. Possible girder... you knooooooow."

The last vowel unwound like a dying siren, lower and lower until Crew's voice rasped, grunted and stopped.

"Hey Crew!"

Silence.

"Hey, come on now."

Silence.

"Stacey here! Stacey here!" he shouted, panic in his voice.

"Control speaking."

A new voice. A calm voice.

"Hey Control we got trouble. Damn thing's stuck. Nothing on the Crew."

"There is a problem, certainly. I am unable to communicate with your ship controller and am therefore contacting you directly to inform you of the facts. The ship controller or Crew appears to be damaged as are other parts of your vessel. I must ask you to consider direct manual operation as the only possibility."

You mean I have to get out of this myself? I'm a Grade 2 man not a senior operator."

(continued on next page)

(continued from previous page)

"I will instruct you in the procedures. First you must operate the ETV2."

"Where's that?"

"Model 3 vessels like yours have the ETV2 cut-off adjacent to the OCB chambers. Safety procedures entail first the operation of the ETV2. Please do this."

"I don't know what the hell you are talking about. Say it in English will you. Or let me speak to a person."

I speak very good English, Stacey. My expert systems were seeded by a retired professor whose knowledge was the tuned and refined product of many years' experience in communications. I will, however, attempt to contact a person for you but it may take several hours to achieve."

"OK. Tell me again."

"First operate the ETV2. It will give you access to the inertial navigation system."

"I tell you, I do not know where it is. Look there is a large red thing on the wall. There are two white ones like arms as well.

"Levers?"

"Yeah, levers. Come on will you. I was told you things never break down. Can't you operate the thing?"

I would not say never break down Stacey although I can monitor I am unable to operate. I agree that the situation is abnormal. Do you know where the contained environment controller is situated? My information leads me to suspect that the CEC is to be found in the vicinity of the ETV2."

"Vicinity? Look, don't use fancy words. Just tell me where the damn thing is."

"I am attempting to."

"My Crew never talked like you."

"Your Crew was self modulating Stacey. My output is never modified. I am designed primarily to interface with computers not people. I reiterate you must continue to attempt to locate the ETV2. Time is running out for you."

"How long have I got then?"

There is air enough for one hour and seven minutes. Anoxia will then set in and also gas narcosis."

"Any other good news?"

"The main tanks appear to have ruptured due to the exterior problem and the regenerator is malfunctioning. The plutonium-238 fuel cells are still operating and your twin 11-horsepower motors are able to turn. There is, however, no response to their thrust. A weight in excess of your 15 tons is preventing this."

"Look all this is making me pretty mad. There must be something you can do? I do not want to die."

I too can get angry Stacey but I feel it more appropriate to remain calm. I see from your records that this journey was unauthorised. Is it possible that you were seeking wrecked ore carriers? If so then it seems that you have been hoist by your own Piccard."

"What?"

"Forgive me a small academic joke. Poor in the circumstances."

"Look I will try anything once Control. Is this ETV2 red or white?"

"White Stacey, and it is clearly labelled."

"You mean words? I can't read, you fool. No one reads. You do all that stuff. What are machines for if not to read? Look I am going to pull this thing here. Now."

Please do not Stacey. Do not be rash. Look I have managed to contact a person for you. I will put you on talk-through. Please communicate."

"Hello. Hello. Who's there? Help me will you?"

"Stace it's Connolly. Hi old buddy. Do like the man says or you are in real trouble."

"But Connolly, tell me in English will you? What do I have to do?"

"Well there are two red levers and a white one. Sorry two white ones and red one. Then a box with a wheel on it. I've got a picture here. Turn the wheel clockwise the man says."

"Which way is clockwise?"

"I don't know. Clockwise has got to be one way or the other. Give it a go."

"Yeah OK. Here goes."

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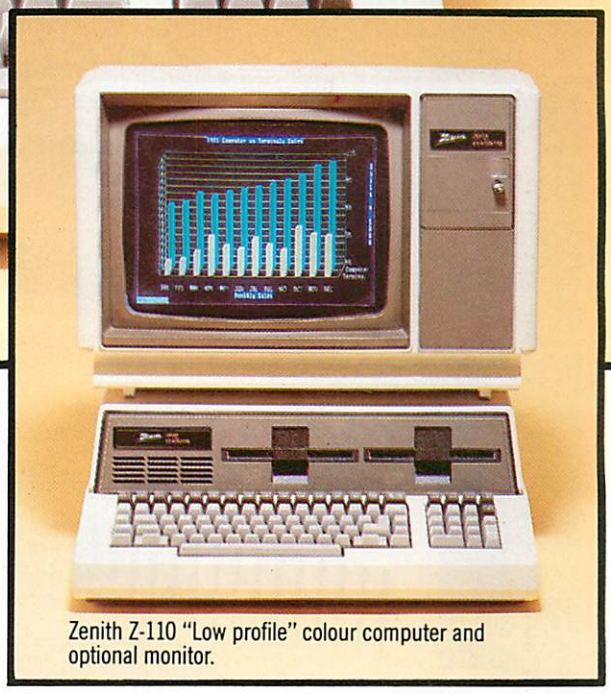

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● Circle No. 16

Bill Bennett investigates the effect of a microcomputer and costing package on a metalworking company.

From teapots to technology

THERE IS SOMETHING about the legal profession and their offices that is definitely anachronistic. They always seem to be 10 or 20 years behind the times, and even if there is the latest technology in evidence they still have an old-fashioned air. There is nothing old-fashioned about Geoffrey Herdman though, and even less about the way in which he conducts his business.

In 1980 Geoffrey Herdman was "looking around for a company to buy". The business that managed to fit the bill was H A Waller and Sons Ltd, a metalworking company in the seaside town of Brighton. Herdman, a chartered accountant by profession, works in a small office at the top of a grand old building in that interesting part of London just off Oxford Street.

When Herdman took over the company, the accounting records were what he describes as "non-existent". He immediately installed a manual Kalamazoo system, which worked "adequately" for the purpose of all normal accounting records. It did not take him long to analyse the main problem of the company: "Although we are metalworkers, with 40 men on the shop floor, we are more a servicing industry than a manufacturing one." The company provides a wide range of services in the metalworking field. The men are called upon to mend copper roofs, repair old ladies' teapots and kettles, or maybe rework a wrought-iron gate.

400 records a week

The most important function in such an industry is to record the time spend on individual jobs. At Wallers this would mean 40 men working on up to 10 jobs per week — a total of about 400 jobs to be recorded every week. Herdman discovered that a manual system for recording all these pieces of time would be self-defeating, because the effort involved in maintaining it would just be so great. Furthermore, nobody could be bothered to run the thing.

It was then that Herdman turned to computers, much earlier than he had originally intended. It was, however, not to perform the regular accounting functions, but the job costing. He knew little about microcomputers despite being a chartered accountant, so he enlisted the aid of an independent advisory service.

The expert he turned to was Delia Venables of the Microcomputer Advisory Service in nearby Lewes. He regarded the fees charged reasonable for the service performed, which was mainly some market research, an analysis of the problem, and providing a write-up. The survey pointed to the two most popular micros of the day, the Apple and the Pet. Herdman decided that the Pet was ideal for his function, though this was around the time that Commodore was introducing the 80-column machines — and the software was not then ready for the 80-column machine.

He looked at a costing package, which he though to be very good. Unfortunately it would take at least another six months to have the package amended for the

(continued on next page)

The introduction of the machine has achieved more than just a straight increase in productivity.

(continued from previous page)
80-column machine. Looking back, Herdman observes: "Apple introduced me to something called the Tabs system. Again the spec was very good, but it used four disc drives connected up to it.

"Every time it asked the user a question all four drives started working, and hence the response time was hopelessly inadequate.

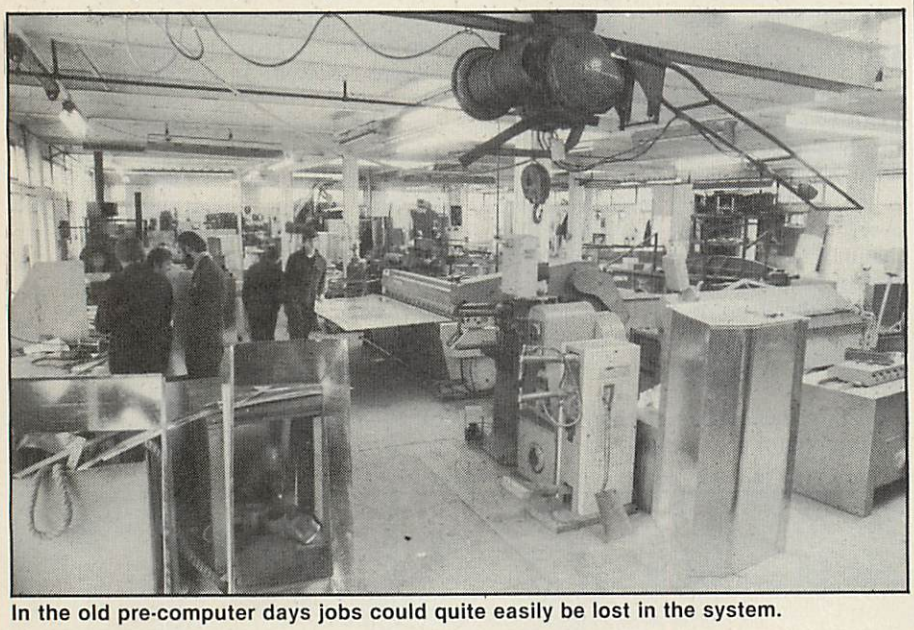
"I like buying English things, be they cars or computers. Just at that time I saw a feature in the *Evening Standard* about LSI computers. I rang Mr Fitzpatrick, the managing director, and went along to LSI more or less the next day to see if there was a costing package". There was. It was tailor-made for someone else, but Herdman was impressed by the response time of the LSI, which was much faster than anything else he had seen. As soon as the answer to one question is input, the next question comes up.

"The response time was excellent, it just knocked spots off the 'home computers' like the Apple and Pet." LSI attributes this speed to the design philosophy: the hardware was designed by engineers who knew in advance what kind of software the machine would be running, unlike systems based on home computers which are bullied into running software. LSI was originally a software house and so the programs were already written. The machine was simply built around them.

In retrospect Herdman feels that the Commodore costing software was much nearer to what he was looking for in a system. It was just that the LSI system seemed to work better. "I went to see the LSI system in the showrooms. Within half an hour I knew what it would be able to tell me. I was also able to work out that it could be adapted to my needs without having anyone rewrite any of it. I also knew what I was going to get out of it.

"Since we had the costing function running on the computer anyway, it made sense to put the normal accounting function on it. In fact, the most useful one for our educational purposes was the payroll. I then moved on to the purchase and sales ledger, and all of that worked very well.

"The significant point is that, in a service industry, the key to the game is productivity. If you have one man working 40 hours a week, and you charge him out at £10 per hour, the theoretical maximum earning power is £400. If you only achieve £200 per week on sales, the productivity is 50 percent. Productivity at Wallers was in fact running at about 50 percent." Herdman decided that he could justify the purchase of the computer, because if it increased the productivity of his staff of 40 by just one percent it would pay for itself within the year.



In the old pre-computer days jobs could quite easily be lost in the system.

Geoffrey Herdman has found the actual rise in productivity brought about by the computer hard to define because of a number of extraneous factors. The machine has helped in two major areas. In the old, pre-computer days jobs could quite easily be lost in the system or records on the jobs could be incomplete. The micro provides a permanent record of all jobs, and they are not taken off the computer until they have been properly invoiced. Herdman takes the jobs off himself, and then only after he is fully satisfied that they have been invoiced. "It's amazing, some jobs that you find for very large amounts, that are outstanding."

The benefits are therefore more than just a straight increase in productivity. The paperwork is simplified by the introduction of the machine, helping the audit trail, and more information is readily available for invoicing purposes.

The machine that Herdman purchased from LSI was the M1, the first in a range that now extends up to the M4. The M1 will only take the one console and as far as he is concerned, the only drawback with the machine is that it is near-impossible to program. As he puts it, "The only people who can program the M1 work for LSI.

"As soon as I got the costing package, I would have like to have had improvements made to it. As I kept telling LSI, it is a service-industry package, which would apply to many customers such as garages, solicitors and accountants for time recording and expenses. I tried to respecify it, but LSI had no one free to do the programming. On the newer M3 machine the CP/M operating system allows anyone to do the programming.

"I have not outgrown my M1. I have just started a new retail company, and if it goes well, then I will have proper stock records for a separate company." The company's telephone salesmen will have access to the stock records and a client database. "At that stage we would have to go to something with larger storage like an M2, so that we could be doing two things at the same time through the computer. I will definitely need to have hard discs, because the disc on the M1 constantly needs to be changed. There is one disc for the purchase ledger and one for the nominal ledger."

No difference

The introduction of the computer made no difference to the manner in which the business was conducted. Geoffrey Herdman would not allow it to: "The only reason that I was able to make sense of the computer was because I am an accountant. I run the show anyway, so I knew exactly what I wanted to get out of it. I had to redesign the input to meet the requirements of the system, and to produce the results that we wanted. It was a simple matter of recoding our information to fit the program."

To start with, the computer met some resistance from the office staff. After all, they are the people most affected by such a system. "Putting the information in is not a lot quicker than using the manual Kalamazoo system, as you still have to code up the invoices. Statement preparation, which is what most affects the office staff, is much quicker.

"The person who really does benefit is me. I have a lot more information at my fingertips. Today, I could tell you exactly who all our customers are and how much business everyone has done. We are not so sophisticated that we can use all information available, with the exception of the costing package."

Each Wednesday morning every member of the workforce fills in a timesheet for the week up to Tuesday night. By Wednesday evening, everyone who has issued jobs will have figures for their labour costs together with the appropriate invoices.

"It is very difficult to tell what effect the introduction of the computer has had on the company," says Herdman. "I took the company over at a terrible time. A metalworking company is at the fag-end

(continued on page 107)

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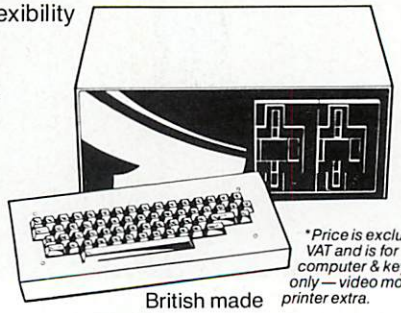

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(continued from page 104)
of the engineering industry, and engineering has been the sector hardest-hit by the recession. But we have survived — the information has helped. To put it another way, I now know more accurately whether I am losing money. Things are also a little more under control."

Better cash flow

Herdman does not feel that because information is to hand more quickly he can react more rapidly to events. The speed benefit of the computer is far more direct than that: it helps the cash flow. The statements for one month's work go out before the end of the first week of the next month, barring any slips or delays caused by holidays and sickness. The theory is that by having the costing information available — and remember, in this business it all comes down to time costing — the business is on a much firmer footing. The firm of H A Waller has an enormous quantity of invoices relative to the size of the turnover. There are an awful lot of £6.50 invoices — this is in the nature of the trade. Thanks to the computer, these statements and invoices can be prepared in a much more regular way.

Because so many customers pay as soon as they receive their statement the system makes a tremendous difference to the cash flow. The time for the money to turn around, from the work being done to the bill being paid, is thus reduced.

There are the usual side benefits from installing the accounting software. Herdman explains: "With 40 people in the company we find that the computer is quicker than a manual method. It certainly is easier."

When he first took over the company the staff asked him how long it would be before he installed a computer. His estimate to them was that it would happen within three years — in fact, it was installed within a few months. Being an accountant, Herdman had gleaned some knowledge of computers, mainly from performing audit trails, while one of his accounts clerks had worked using a Kalamazoo system for 27 years.

To allay the fears which naturally arise when new technology is in the offing Herdman took his clerks along whenever he went to look at any computer equipment. Though they had no previous experience of computers they both find it easy to use, and like its speed and efficiency. Yet there are still times when they wish it would go a little faster. One of them works on the computer a couple of days a week but feels that working on it all week would drive her mad.

Funnily enough, operators always seem to find the most interesting things happen when data is entered incorrectly. Maybe there is a lesson here for software designers. Because data entry is boring, operators find that errors wake them up. The two clerks at H A Waller are more than just operators. They see the whole job through, performing all the other tasks involved with the work, and this is the one sure way of ensuring a measure of job satisfaction.

Sold on computers

Although he is sold on computers, Herdman feels that the company's regular accounting does not need a computer. The volume, though high on paperwork, is such that the invoices are still done manually and are all posted to the Kalamazoo system. He tried operating a manual costing system himself before deciding in favour of automation.

Geoffrey Herdman has strong views about how companies should install computers. He feels being both an accountant and owner of his company made the task fairly easy, but he sympathises deeply with any accountant who has been instructed by a managing director to computerise and then has to start from scratch. The strong point in his favour, he believes, was that he could retain firm personal control at all stages.

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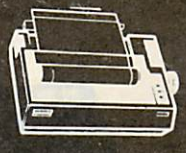

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TS802

2 x 5¼" integral floppy drives (720Kb formatted) Z80A, 64Kb, 2 serial RS232 ports, 1 RS422 comms. port. CP/M*

TS802H

as TS802 with one floppy drive replaced by a 10MB 5¼" Winchester

TS806

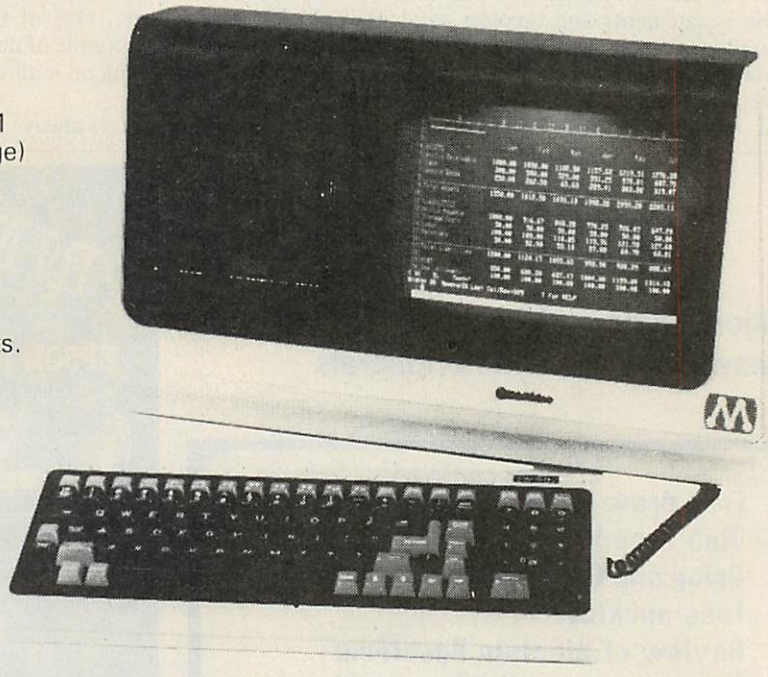
The TS806 is a high performance multi-tasking, multi-processor computer system supporting up to six users, each running CP/M* and having access to central Winchester/ floppy disc mass storage. High speed (800K baud) comms. are employed — each user station can be TS802, TS801 or TS800 work station (no mass storage)

TS816

The TS816 is a 16-user version of the TS806, providing 23.5 MB 8" Winchester with mag. tape back-up and 16 RS422 high-speed comms. ports.

* *TM Digital Research*

an exciting new range of Microcomputer Systems suitable for both single and multi-user applications



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The K9 Terminal is undoubtedly one of the most competitively priced terminals available on the market today which can offer so many outstanding features.

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Main features:

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The Insight Terminal is again, extremely competitively priced offering an even greater amount of features than the K9.

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A
SI

THE 16-BIT PERSO

The ACT Sirius 1 is more than the UK's best-selling 16-bit personal computer. It is the only one with such a large choice of 16-bit software — business and scientific programs specially developed to take advantage of the high speed 16-bit Intel 8088 microprocessor at the heart of every Sirius.

Combine this faster and more powerful software with the advanced specifications of the Sirius 1 and you can see why more and more business users are choosing Sirius.

Because Sirius users have both the latest microcomputer technology and the powerful 16-bit software that takes full advantage of it.

Ergonomics plays a vital part in the design of ACT's Sirius 1. The screen tilts and swivels to suit the user and glare is eliminated.

The display is razor sharp, and the brilliance and contrast can be adjusted using keys on the low profile detachable keyboard.

UP TO 896 KBYTES RAM

128 Kbytes of RAM memory as standard easily upgraded to a massive 896 Kbytes ensures plenty of capacity for fully fledged business software and associated record files.

Within the basic system is 1.2 Mbytes of floppy disk storage, with 2.4 Mbytes double sided disks available as an option. More than any other comparable personal computer.

As a result, the Sirius is suitable from the start for large record processing applications. And with 5 and 10 Mbyte Winchester disk drives scheduled for early introduction, the Sirius can easily match your own organisation's growth.

SOFTWARE THAT TALKS BACK

And built into every Sirius is a revolutionary new concept: An audio decoder that can play back verbal messages and prompts under program instruction to assist the non-computer people to get acquainted with the software more quickly.

NEW 16-BIT SOFTWARE

All the big names in applications software are on the Sirius: ACT's Pulsar for accounting, WordStar for word processing, MicroModeller for financial modelling and SuperCalc the "spread sheet" program.

Plus the exciting SELECT, the only word processor that teaches you how to use it in less than 90 minutes.

And more than 100 top software companies are currently developing specialist software for every business and profession from the motor trade to solicitors.

The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions.

ACT products include personal computers — network micro-computer systems — turnkey mini computers and a total range of services, including software development, computer field engineering, computer supplies, and a complete range of Bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.

CT
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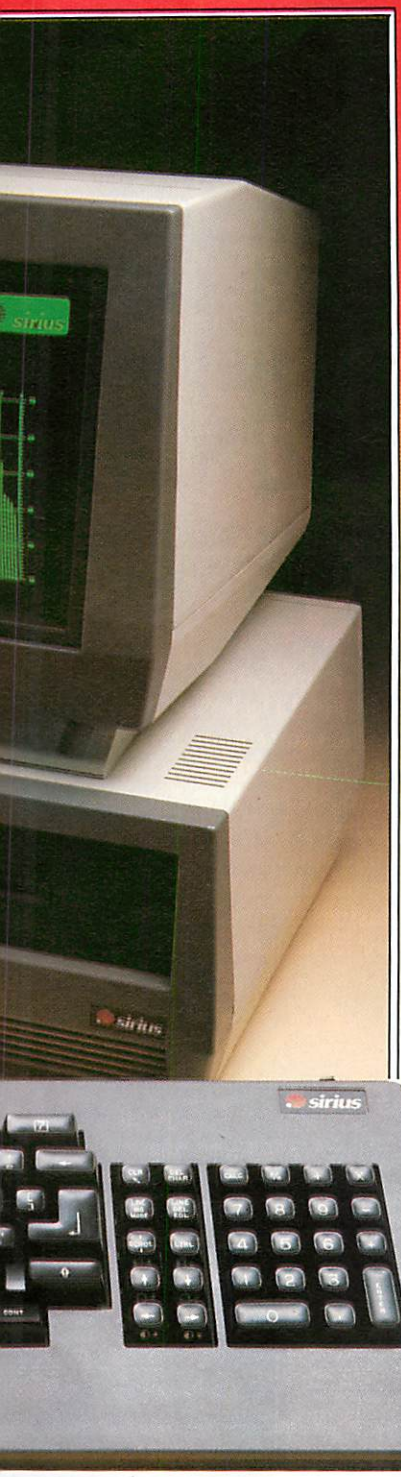
Price £2,395



MORE LANGUAGES

The Sirius has more available programming languages than any newly-introduced personal computer. MicroSoft's BASIC 86, interpretative or compiled, CBASIC, a choice of several versions of COBOL, three different PASCAL's and a full scale FORTRAN.

The benefits? Programmers and software houses are making the Sirius their first choice computer for business software development.

Unlike other personal computers, the ACT Sirius 1 is delivered with the two industry standard operating systems at 16-bit level — MS-DOS and CP/M-86. Once again a guarantee now of the widest choice of off-the-shelf 16-bit software.

And further operating systems are under development. The much vaunted UNIX and a new system to support a low cost local area network.

COMMUNICATIONS

The Sirius is the ideal communications system, with two independent RS232 communications ports in addition to parallel and IEEE 488 ports. Available NOW are all the facilities required to communicate directly with large, mainframe computers.

Further backing is available by way of a dedicated Sirius Training Centre, run by ACT and open to all.

To support the product ACT has a truly professional network of systems dealers, hand picked for its knowledge of the business environment, enabling top quality support to always be close at hand.

ACT SIRIUS 1 — THE COMPLETE 16-bit personal computer.

To know more about the 16-bit ACT Sirius 1 and its exciting range of 16-bit software, clip the coupon and return it to:—

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Accounting Business Systems

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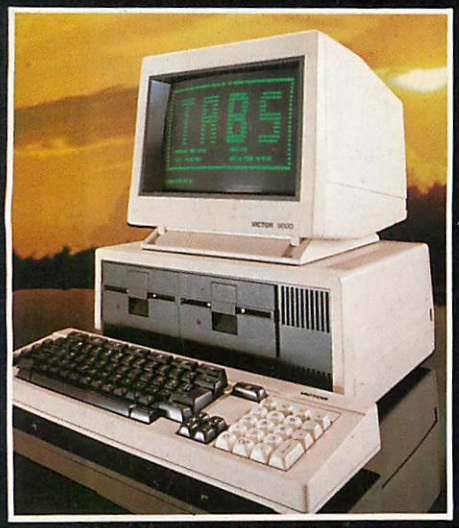

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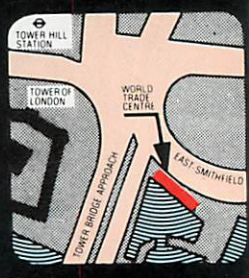
Not only is the system designed to help with all the functions of a busy office but it is also designed to run on most micro-computers including the "new generation" 16 bit machines.

With over 2,500 installations and over 14,000 modules being run in the UK and overseas its unparalleled success has been due not only to the proven quality of the software but also to the friendly, unbiased advice that we give our visitors at our regular free seminars and demonstrations held throughout the country.

Further, great care is taken in training our Accredited Dealers and our end users so that when you choose TABS software you are also choosing a product which is fully supported both by your Accredited Dealer and by TABS own personnel.

To find out how the businessman's number one choice would help you and your business phone **Andover (0264) 58933** or fill in the coupon.

Free London Demonstrations and Seminars are held at the World Trade Centre within a few minutes walk of Tower Hill tube station.



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128K 1995
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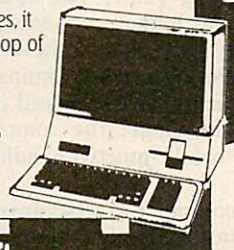

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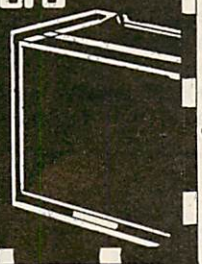

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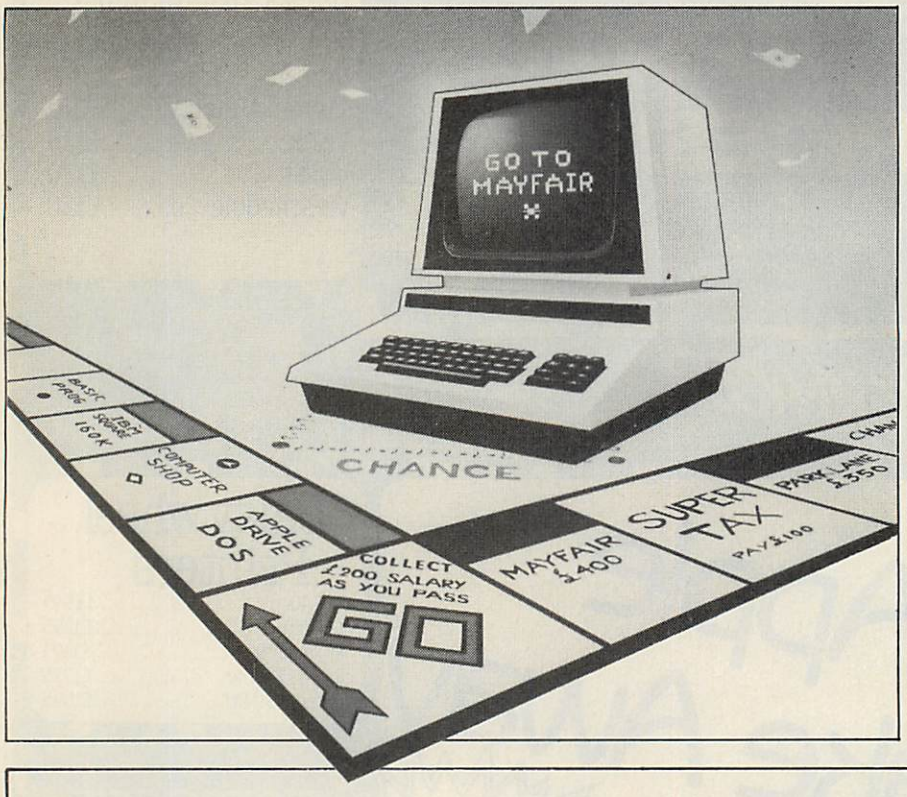
Microcomputer plays



Mark Callaway has written a program which makes paper money and chance cards a thing of the past.

PET MONOPOLY was developed as a simple exercise in artificial intelligence which at the same time generates a playable and entertaining game. The computer plays against a human opponent, following precisely the rules of the original board game. Pet Monopoly eliminates the need for paper money, title deed cards, etc. of the board game: the computer acts as banker while quietly handling all these items.

The computer's tactics are strongly biased against undevelopable properties, that is, stations and utilities and the green Bond Street set. Lines 35000 onwards may be rewritten if you wish to change the computer's bias.

Line 35000 begins the subroutine which decided if the compute should buy a

```
 0 REM COPYRIGHT 27 APRIL 1982
 1 REM PET MONOPOLY
 2 REM BY MARK CALLAWAY
 3 REM 10 LEALANDS,
 4 REM LESBURY,
 5 REM ALNWICK,
 6 REM NORTHUMBERLAND.
 9997 II$="YPLH#BCMOUSEVW#↑"
 9998 DATA162,255,189,255,127,201,32,240,10,201,96,240,6,169,1,141,255,3,96,202,
208
 9999 DATA236,169,0,141,255,3,96
 10000 FORX=826TO853:READA:POKEX,A:NEXT:TY=1:W7=1:A9=1
 10005 DIMCC%(15,2),CH%(15,2),C$(15),H$(15),B%(40,11),D$(40),02(10,2),03(39)
 10050 FORW=0TO39:FORY=0TO7:READB%(W,Y)
 10055 IFB%(W,0)=0THEN10059
 10056 NEXTY:READB%(W,11)
 10059 READD$(W):NEXTW
 10100 WE$="●xO@✱✱✱=!#"
 10110 DIMDD$(6):FORX=1TO6:READDD$(X):NEXT
 10120 GOTO17990
 10130 GOTO11800
 10131 GOSUB11160
 10140 GOSUB11590:PRINT"■YOUR":PRINT"THROW":R=T:FORX=1TO2500:NEXTX
 10150 GOSUB11590:PRINT"■MY  ":PRINT"THROW"
 10160 IFR=TTHEN10190
 10170 IFR>TTHENPRINT"■YOU ":PRINT"START":FORX=1TO5000:NEXT:GOTO11890
 10180 PRINT"■I    ":PRINT"START":FORX=1TO4000:NEXT:GOTO11900
 10190 PRINT"■DRAW":FORX=1TO3000:NEXT:PRINT"┐    ":PRINT"I":GOTO10140
 10210 DATA0,GO,60,50,2,10,30,90,160,250,1,OLD KENT ROAD,0,COMMUNITY CHEST
 10230 DATA60,50,4,20,60,180,320,450,1,"WHITECHAPEL ROAD",0,INCOME TAX $200
 10250 DATA200,0,0,0,0,0,0,0,2,"KINGS CROSS STATION"
 10260 DATA100,50,6,30,90,270,400,550,3,"THE ANGEL,ISLINGTON",0,CHANCE
 10280 DATA100,50,6,30,90,270,400,550,3,"EUSTON ROAD"
 10290 DATA120,50,8,40,100,300,450,600,3,PENTONVILLE ROAD,0,JAIL
 10310 DATA140,100,10,50,150,450,625,750,4,"PALL MALL"
 10320 DATA150,0,0,0,0,0,0,0,5,"ELECTRIC COMPANY"
 10330 DATA140,100,10,50,150,450,625,750,4,"WHITEHALL"
 10340 DATA160,100,12,60,180,500,700,900,4,"NORTHUMBERLD AVE."
 10350 DATA200,0,0,0,0,0,0,0,2,"MARYLEBONE STATION"
 10360 DATA180,100,14,70,200,550,750,950,6,BOW STREET,0,COMMUNITY CHEST
 10380 DATA180,100,14,70,200,550,750,950,6,"MARLBOROUGH ST."
 10390 DATA200,100,16,80,220,600,800,1000,6,VINE STREET,0,FREE PARKING
 10410 DATA220,150,18,90,250,700,875,1050,7,THE STRAND,0,CHANCE
 10430 DATA220,150,18,90,250,700,875,1050,7,"FLEET STREET"
 10440 DATA240,150,20,100,300,750,925,1100,7,"TRAFALGAR SQUARE"
 10450 DATA200,0,0,0,0,0,0,0,2,"FENCHURCH ST. STATION"
 10460 DATA260,150,22,110,330,800,975,1150,8,"LEICESTER SQUARE"
 10470 DATA260,150,22,110,330,800,975,1150,8,"COVENTRY STREET"
 10480 DATA150,0,0,0,0,0,0,0,5,"WATER WORKS"
 10490 DATA280,150,22,120,360,850,1025,1200,8,PICCADILLY,0,GOTO JAIL
 10510 DATA300,200,26,130,390,900,1100,1275,9,"REGENT STREET"
 10520 DATA300,200,26,130,390,900,1100,1275,9,OXFORD STREET,0,COMMUNITY CHEST
 10540 DATA320,200,28,150,450,1000,1200,1400,9,"BOND STREET"
 10550 DATA200,0,0,0,0,0,0,0,2,"LIVERPOOL ST. STATION",0,CHANCE
 10570 DATA350,200,35,175,500,1100,1300,1500,10,PARK LANE,0,SUPER TAX $100
 10590 DATA400,200,50,200,600,1400,1700,2000,10,"MAYFAIR"
 10591 DATA"◪   ▩▩▩▩ ● ▩▩▩▩  "
 10592 DATA"◪●  ▩▩▩▩_ ▩▩▩▩  ●"
 10593 DATA"◪●  ▩▩▩▩ ● ▩▩▩▩  ●"
 10594 DATA"◪● ●▩▩▩▩   ▩▩▩▩● ●"
 10595 DATA"◪● ●▩▩▩▩ ● ▩▩▩▩● ●"
 10596 DATA"◪● ●▩▩▩▩● ●▩▩▩▩● ●"
 10600 DATA"■ MUST MAKE GENERAL REPAIRS ON ALL OF ▮ HOUSES",0
 10610 DATA"↑ ■ ASSESSED FOR STREET REPAIRS",0
 10620 DATA"TAKE A TRIP TO MARLYLEBONE STATION",0,ADVANCE TO MAYFAIR,0
 10640 DATA"ADVANCE TO TRAFALGAR SQUARE",0,ADVANCE TO PALL MALL,0
 10660 DATA"ADVANCE TO GO",0,GO BACK THREE SPACES,0
 10690 DATAGO TO JAIL,0,"GET OUT OF JAIL FREE",0
 10700 DATA"DRUNK IN CHARGE FINE $20",-20
 10710 DATA"SPEEDING FINE $15",-15
 10720 DATA"BANK PAYS ■ DIVIDEND OF $50",50
 10730 DATA"▮ BUILDING LOAN MATURES RECEIVE $150",150
 10740 DATA"PAY SCHOOL FEES OF $150",-150
 10750 DATA"■ HAVE WON A CROSSWORD COMPETITION    COLLECT $100",100
 10760 DATA"ADVANCE TO GO",0,GOTO JAIL,0
 10780 DATA"GET OUT OF JAIL FREE",0,GO BACK TO OLD KENT ROAD,0
 10800 DATA"IT IS ▮ BIRTHDAY COLLECT $10",0
 10810 DATA"PAY A $10 FINE OR TAKE A CHANCE",0
 10820 DATA"BANK ERROR IN ▮ FAVOUR COLLECT $200",200
 10830 DATA"DOCTORS FEE PAY $50",-50
 10840 DATA"RECIEVE INTEREST ON 7% PREFERENCE SHARES$25",25
 10850 DATA"INCOME TAX REFUND COLLECT $20",20
 10860 DATA"PAY ▮ INSURANCE PREMIUM $50",-50
 10870 DATA"FROM SALE OF STOCK ↑ GET $50",50
 10880 DATA"↑ INHERIT $100",100
 10890 DATA"ANNUITY MATURES COLLECT $100",100
 10900 DATA"PAY HOSPITAL $100",-100
 10910 DATA"■ HAVE WON SECOND PRIZE IN A BEAUTY   CONTEST COLLECT $10",10
 10920 REMF$=IN,G$=OUT
 10930 Q=LEN(F$)
 10940 G$=F$
 10950 FORX=1TOQ:IFASC(MID$(G$,X,1))>192THEN10970
 10960 Q=LEN(G$):NEXTX:RETURN
 10970 A$=LEFT$(G$,X-1):B$=RIGHT$(G$,Q-X):C$=MID$(G$,X,1)
 10980 IFC$="↑"ANDTY=1THENC$="I":GOTO11060
 10990 IFC$="↑"ANDTY=2THENC$="YOU":GOTO11060
 11000 IFC$="▮"ANDTY=1THENC$="MY":GOTO11060
 11010 IFC$="▮"ANDTY=2THENC$="YOUR":GOTO11060
 11020 IFC$="■"ANDTY=1THENC$="ME":GOTO11060
 11030 IFC$="■"ANDTY=2THENC$="YOU":GOTO11060
 11040 IFC$="■"ANDTY=1THENC$="AM":GOTO11060
 11050 IFC$="■"ANDTY=2THENC$="ARE":GOTO11060
 11054 IFC$="■"ANDTY=1THENC$="I ":GOTO11060
 11055 IFC$="■"ANDTY=2THENC$="YOU":GOTO11060
 11060 G$=A$+C$+B$:GOTO10960
 11070 PRINT"■IF YOU EVER WANT TO SAVE A GAME ON TAPE OR DISK,HOW WOULD YOU LIK
E";
 11080 PRINT" TO DO IT-"
 11090 PRINT"1) ON TAPE #1"
 11110 PRINT"3) ON DISK #0"
 11111 PRINT"4) ON DISK #1"
 11120 PRINT"■ TYPE IN YOUR CHOICE";
 11130 INPUTW6
 11140 IFW6<10RW6>4THEN11130
 11141 IFW6<3THEN11150
 11142 PRINT"HAS FILE#1 BEEN OPENED AS A COMMAND     CHANNEL (Y-N)?"
 11143 GETA$:IFA$=""THEN11143
 11144 IFA$="Y"THENCLOSE1:GOTO17780
 11145 IFA$<>"N"THEN11143
 11150 GOTO17780
 11160 IFS1=1THEN11780
 11161 PRINT"▮▮▮
```

human at Monopoly

property or not. Q is the number of the property, 0 to 39, and Q1 is set to 1 if the player has already been offered the chance to buy the property but has refused. The subroutine sets Q3 to 1 if the computer buys the property, and 0 if it should not. Lines 35000 to 35030 calculate the assets of the computer and stores this value in XT, which represents the value of the Pet's cash plus the mortgage value of its unmortgaged, undeveloped property.

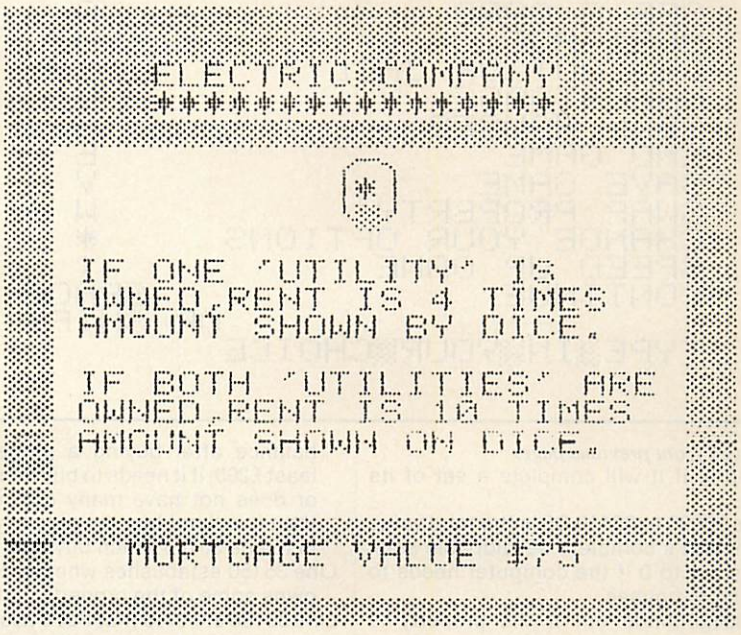
In line 30000 the rows in matrix Q2 correspond to each set number. Column zero is the number of unowned properties in that set, column one is the number of properties in that set owned by the Pet and column two is the number owned by the player.

Line 35050 computes whether the cost of the property is greater than the Pet's assets.

Line 35060 separates developable from undevelopable sets.

Line 35070 finds out whether the property in question will complete a set for the player; unless the player has already refused to buy it then the computer buys it. Line 35080 causes the Pet to buy the

(continued on next page)


ELECTRIC COMPANY
IF ONE 'UTILITY' IS OWNED, RENT IS 4 TIMES AMOUNT SHOWN BY DICE.
IF BOTH 'UTILITIES' ARE OWNED, RENT IS 10 TIMES AMOUNT SHOWN ON DICE.
MORTGAGE VALUE $75

```
11190 FORX=33736TO33736+21:POKEX,99:NEXT
11200 PRINT"■■■■■■■■■GO■DK■CC■NC■IN■X■RI■CH■ERPV■JA"
11210 PRINT"■■■■■■■■D▷■●■■■●■●■■■××■■DO■■■■OOOO■IL"
11220 PRINT"■■■■■■■■■MF■■                    ■PM■■"
11230 PRINT"■■■■■■■■■##■■ ";SPC(16);" ■@@■"
11240 PRINT"■■■■■■■■■STI ";SPC(16);" ■EC■■"
11250 PRINT"■■■■■■■■■■■! ";SPC(16);" ■■■■"
11260 PRINT"■■■■■■■■■■PL■■ ";SPC(16);" ■NH■■"
11270 PRINT"■■■■■■■■■■##■■ ";SPC(16);" ■@@■"
11280 PRINT"■■■■■■■■■CHI ";SPC(16);" ■NA■■"
11290 PRINT"■■■■■■■■■■■! ";SPC(16);" ■@@■"
11300 PRINT"■■■■■■■■■LS■■   ● =YOU          MS■■"
11310 PRINT"■■■■■■■■■▷◁■■   ✱ =ME           ▷◁■■"
11320 PRINT"■■■■■■■■■■BD■■ ";SPC(16);" ■BS■■"
11330 PRINT"■■■■■■■■■■!■■ ";SPC(16);" ■●●■■"
11340 PRINT"■■■■■■■■■CCI ";SPC(16);" ICC■■"
11350 PRINT"■■■■■■■■■■■! ";SPC(16);" ■■■■"
11360 PRINT"■■■■■■■■■■OX■■ ";SPC(16);" ■ML■■"
11370 PRINT"■■■■■■■■■■■!■■ ";SPC(16);" ■●●■■"
11380 PRINT"■■■■■■■■■■RS■■ ";SPC(16);" ■VS■■"
11390 PRINT"■■■■■■■■■■■!■■                ■●●■■"
11400 PRINT"■■■■■■■■■■■GO■PC■■■WN■CVL■■■FS■TS■■FS■CH■ST■■FR"
11410 PRINT"■■■■■■■■■■TO■■==■■■====■××■●●■■●●■■■■■●●■■■EE?"
11480 FORW=0TO39:Z=BX(W,9):IFZ=0THEN11500
11490 GOSUB11520
11500 NEXTW
11510 GOTO11630
11520 IFW<11THENXX=W:Y=0:GOTO11560
11530 IFW<21THENXX=10:Y=W-10:GOTO11560
11540 IFW<31THENXX=30-W:Y=10:GOTO11560
11550 XX=0:Y=40-W
11560 POKE32896+(XX*2)+(Y*80),176+Z
11570 RETURN
11580 RETURN
11590 FORX=1TO10:X7=INT(RND(1)*6)+1:Y7=INT(RND(1)*6)+1
11600 REM
11610 PRINT"■M";DD$(X7);"■■■■■M";DD$(Y7)
11620 T=X7+Y7:NEXT:RETURN
11630 W=U:GOSUB11640:U2=XX:U3=Y:W=P:GOSUB11640:P2=XX:P3=Y:GOTO11690
11640 IFW<11THENXX=W:Y=0:GOTO11680
11650 IFW<21THENXX=10:Y=W-10:GOTO11680
11660 IFW<31THENXX=30-W:Y=10:GOTO11680
11670 XX=0:Y=40-W
11680 RETURN
11690 U4=32897+U2*2+(U3*80)
11700 P4=32897+P2*2+(P3*80)-40
11710 U6=PEEK(U4):P6=PEEK(P4)
11720 PRINT"■■■■■■■■■■■■■TTD■■PRESS ANY KEY■■"
11730 PRINT"■■■■■■■■■■■■■■TO CONTINUE■■"
11740 POKEU4,81:FORX=1TO100:NEXT
11750 POKEU4,U6:POKEP4,42:FORX=1TO100:NEXT
11760 POKEP4,P6:FORX=1TO100:NEXT
11770 GETA$:IFA$=""THEN11740
11780 PRINT"■";
11790 RETURN
11800 FORX=0TO15:CH%(X,1)=-1:CC%(X,1)=-1:NEXT
11801 FORX=0TO15
11810 Z=INT(RND(1)*16)
11820 IFCH%(Z,1)<>-1THEN11810
11830 READH$(X),CH%(Z,1):CH%(Z,2)=X:NEXTX
11840 FORX=0TO15
11850 Z=INT(RND(1)*16)
11860 IFCC%(Z,1)<>-1THEN11850
11870 READC$(X),CC%(Z,1):CC%(Z,2)=X:NEXTX
11880 GOTO10131
11890 TY=2:DO=0
11900 IFTY=1THEN11970
11910 IFUA=1THEN11940
11920 IFUA>1THENUA=UA-1
11930 GOTO12040
11940 IFCJ=2THENUA=0:CJ=0:PRINT"YOU'RE FREE":GOTO12030
11950 IFHJ=2THENUA=0:HJ=0:PRINT"YOU'RE FREE":GOTO12030
11960 UM=UM-50:UA=0:GOSUB17230:PRINT"YOU'RE FREE":GOTO12030
11970 IFPA=10R(PA)1ANDUL<6ANDPM>500)THEN12000
11980 IFPA>0THENPA=PA-1:GOTO12040
11990 GOTO12040
12000 IFCJ=1THENPA=0:CJ=0:PRINT"I'M FREE!":GOTO12030
12010 IFHJ=1THENPA=0:HJ=0:PRINT"I'M FREE!":GOTO12030
12020 PM=PM-50:PA=0:GOSUB17230:PRINT"I'M FREE"
12030 SYS826:IFPEEK(1023)=1THENFORX=1TO5000:NEXT
12040 REM
12050 IFS2=1THENX7=INT(RND(1)*6)+1:Y7=INT(RND(1)*6)+1:T=X7+Y7:GOTO12090
12051 PRINT"■":GOSUB11590
12060 IFTY=2THENPRINT"■MY■OUR■■■■THROW":GOTO12080
12070 PRINT"■MY■■■THROW"
12080 FORX=1TO2500:NEXT
12090 IFX7=Y7THENDO=DO+1:GOTO12120
12100 REM
12110 DO=0:GOTO12200
12120 IFDO<3THEN12160
12130 PRINT"■":IFTY=2THEN12150
12140 P=10:PA=3:PRINT"I'M IN JAIL":FORX=1TO5000:NEXT:DO=0:GOSUB11160:GOTO14160
12150 U=10:UA=3:PRINT"YOU'RE IN JAIL":FORX=1TO5000:NEXT:DO=0:GOSUB11160:GOTO141
50
12160 IFTY=2THEN12190
12170 IFPA>0THENPA=0:PRINT"■I'M FREE":FORX=1TO3000:NEXT
12180 GOTO12200
12190 IFUA>0THENUA=0:PRINT"■YOU'RE FREE":FORX=1TO3000:NEXT
12200 IFTY=2THEN12230
12210 IFPA>0THENPRINT"■I'M STILL IN JAIL":GOTO14150
12220 GOTO12240
12230 IFUA>0THENPRINT"■YOU'RE STILL IN JAIL":GOTO14150
12240 IFTY=2THEN12270
12250 P=P+T:IFP>39THENP=P-40:FL=PL+1:PM=PM+200
12260 GOTO12280
12270 U=U+T:IFU>39THENU=U-40:UL=UL+1:UM=UM+200
12280 GOSUB11160:GOTO18860
12290 IFTY=2THEN12320
12300 IFP=4THENPM=PM-200:PRINT"THAT COST ME $200":GOSUB17230:GOTO14150
12310 GOTO12330
12320 IFU=4THENUM=UM-200:PRINT"THAT COST YOU $200":GOSUB17230:GOTO14150
12330 IFTY=2THEN12360
12340 IFP<>7ANDP<>22ANDP<>36THEN12800
12350 GOTO12370
12360 IFU<>7ANDU<>22ANDU<>36THEN12800
12370 F$=H$(CH%(0,2)):GOSUB10920:PRINTG$
12380 IFCH%(0,2)>9THEN12480
12390 IFHJ<>0THENGOSUB12410:PRINT"■";:GOTO12370
12400 GOTO12470
12410 X1=CH%(0,1):X2=CH%(0,2)
12420 REM
12430 FORX=1TO15
12440 CH%(X-1,1)=CH%(X,1):CH%(X-1,2)=CH%(X,2)
12450 NEXTX:CH%(15,1)=X1:CH%(15,2)=X2
```

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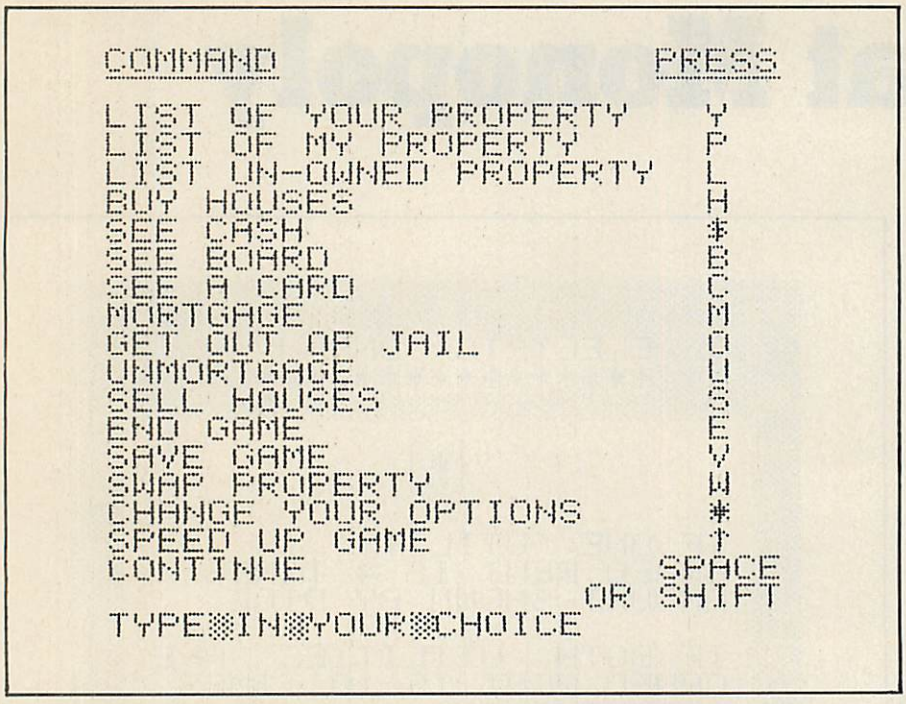


(continued from previous page)

property if it will complete a set of its own.

In lines 35090 to 35110 Q5 is the total value of the Pet's complete developable sets; Q4 is set to 0 if the computer needs to buy more houses.

Line 35120 finds out if the property is developable but is not the green set.

Line 35130 ensures that the Pet's cash balance after buying a property is at least £200; if it needs to buy more houses or does not have many complete sets then it will not buy the property. Default is to line 35140 which buys the property.

Line 35150 establishes whether the player owns some of the property in the set.

Line 35160 ensures that Pet's assets are at least £100 more than the cost of the property.

In line 35170 the computer buys the property.

Line 35180 calculates whether the total value of the Pet's complete developable sets is greater than £1200, if it is, then the computer does not buy it.

The AI element of the routines for swapping and buying property were developed by analysing conventional Monopoly play, breaking it down into simple If-Then statements. The property swaps are very simple, involving only the exchange of two properties, with no cash subsidies. The two chunks of program concerned with swapping are lines 20000 to 21000, where the player asks to swap by pressing W, and lines 16760 to 17180, where the computer itself proposes the deal. For a swap to go ahead, the Pet must have more than £1000, it must receive a complete set of developable properties which are more valuable than any set the player may receive, the property it receives must be unmortgaged and the Pet must not give away one of a complete set.

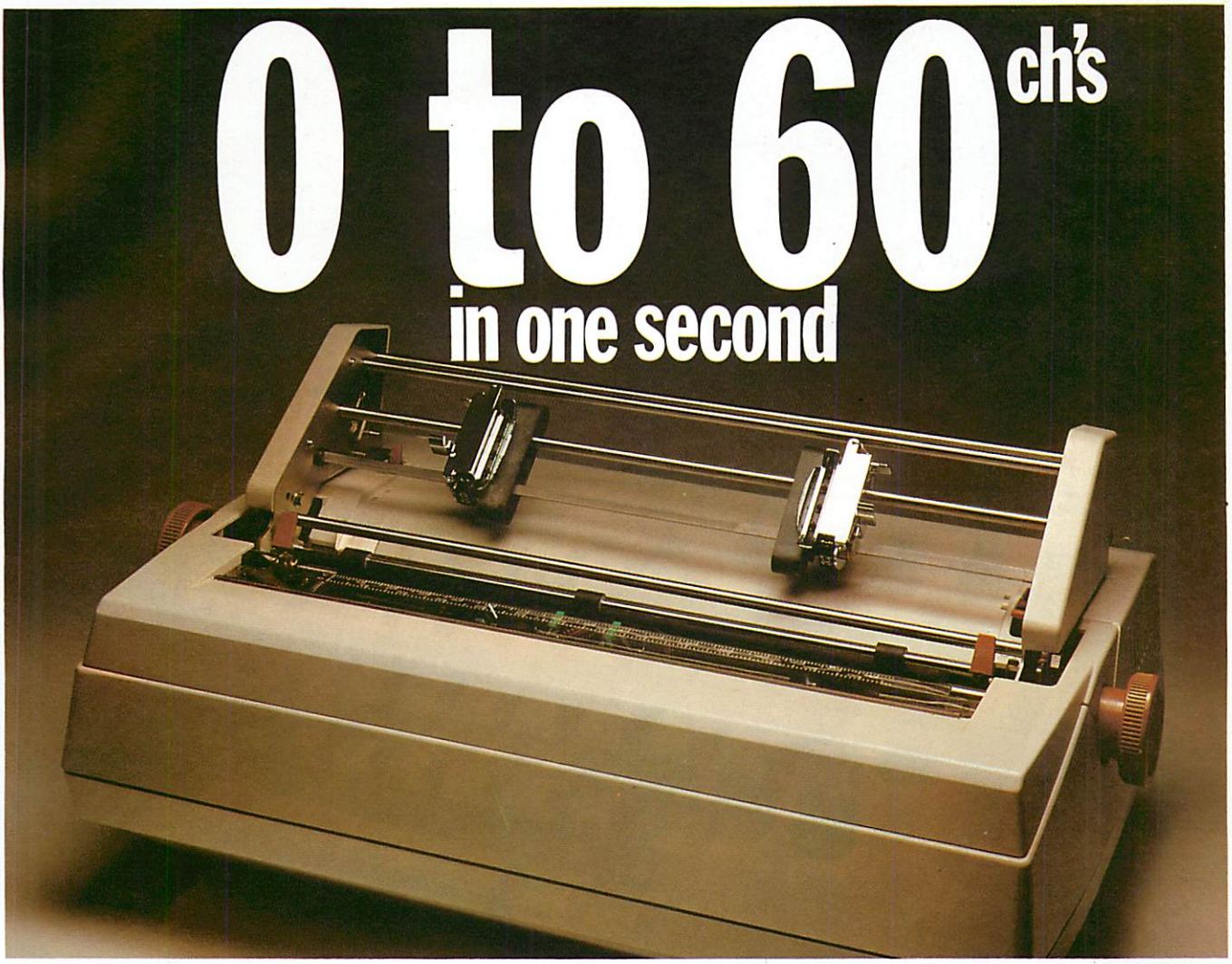
In line 20080, the computer will not accept a mortgaged property, even in exchange for another mortgaged property. If the face value of the property which the computer is going to receive is less than the face value of the property it is giving away then the swap is blocked by line 20090. The same line blocks swap for an undevelopable property — a station or utility — or a property the player does not

(continued on page 121)

(listing continued from previous page)

```
12460 RETURN
12470 SYS826:IFPEEK(1023)=1THENFORX=1TO2000:NEXT
12471 HJ=TY:GOTO12790
12480 SYS826:IFPEEK(1023)=1THENFORX=1TO2000:NEXT
12481 IFCH%(0,2)<>0ANDCH%(0,2)<>1THEN12590
12490 IFCH%(0,2)=1THENHY=115:HZ=40:GOTO12510
12500 HY=100:HZ=25
12510 O=0:FORX=0TO39
12520 IFB%(X,8)<>TYTHEN12550
12530 IFB%(X,9)=5THENO=O+HY:GOTO12550
12540 O=O+(B%(X,9)*HZ)
12550 NEXTX
12560 IFTY=2THEN12580
12570 PM=PM-O:PRINT"THAT COST ME #";O:GOSUB17230:GOTO12790
12580 UM=UM-O:PRINT"THAT COST YOU #";O:GOSUB17230:GOTO12790
12590 IFCH%(0,2)<>8THEN12610
12600 GOSUB12410:GOTO12130
12610 IFCH%(0,2)<>7THEN12640
12620 IFTY=2THENU=U-3:GOSUB12410:GOTO12280
12630 P=P-3:GOSUB12410:GOTO12280
12640 IFCH%(0,1)=0THEN12670
12650 IFTY=2THENUM=UM+CH%(0,1):GOSUB17230:GOTO12790
12660 PM=PM+CH%(0,1):GOSUB17230:GOTO12790
12670 X=CH%(0,2):MA=0
12680 IFX=2THENXX=15
12690 IFX=3THENXX=39
12700 IFX=4THENXX=24
12710 IFX=5THENXX=11
12720 IFX=6THENXX=0
12730 IFTY=2THEN12760
12740 IFP>=XXTHENMA=200:P=P-40
12750 GOTO12770
12760 IFU>=XXTHENMA=200:U=U-40
12770 IFTY=2THENU=XX:UM=UM+MA:GOSUB12410:UL=UL+(MA/200):GOTO12280
12780 P=XX:PM=PM+MA:GOSUB12410:PL=PL+(MA/200):GOTO12280
12790 GOSUB12410:GOTO14150
12800 IFTY=2THEN12830
12810 IFP<>2ANDP<>17ANDP<>33THEN13160
12820 GOTO12840
12830 IFU<>2ANDU<>17ANDU<>33THEN13160
12840 GOTO12900
12850 X1=CC%(0,1):X2=CC%(0,2)
12860 FORX=1TO15
12870 CC%(X-1,1)=CC%(X,1):CC%(X-1,2)=CC%(X,2)
12880 NEXTX:CC%(15,1)=X1:CC%(15,2)=X2
12890 RETURN
12900 F#=C#(CC%(0,2)):GOSUB10920:PRINTG#:IFCC%(0,2)<>1THEN12920
12910 GOSUB12850:GOTO12130
12920 IFCC%(0,2)<>2THEN12950
12930 IFJ<>0THENGOSUB12850:PRINT"□";:GOTO12900
12940 CJ=TY:GOTO13150
12950 IFCC%(0,2)<>3THEN12980
12960 IFTY=2THENU=1:GOSUB12850:GOTO12280
12970 P=1:GOSUB12850:GOTO12280
12980 IFCC%(0,2)<>4THEN13020
12990 IFTY=2THEN13010
13000 PM=PM+10:UM=UM-10:GOSUB17230:GOTO13150
13010 PRINT"HAPPY BIRTHDAY":PM=PM-10:UM=UM+10:GOSUB17230:GOTO13150
13020 IFCC%(0,2)<>5THEN13100
13030 IFTY=2THEN13060
13040 IFPL<5THENPRINT"I'LL TAKE A CHANCE":GOSUB12850:GOTO12370
13050 PRINT"I'LL PAY THE FINE":PM=PM-10:GOSUB17230:GOTO13150
13060 PRINT"FINE OR CHANCE (F-C)? ":GOSUB18440
13070 IFA$="C"THENGOSUB12850:GOTO12370
13080 IFA$="F"THENUM=UM-10:GOSUB17230:GOTO13150
13090 GOTO13060
13100 IFCC%(0,1)<>0THEN13130
13110 IFTY=2THENU=0:UM=UM+200:GOSUB12850:GOTO12280
13120 P=0:PM=PM+200:GOSUB12850:GOTO12280
13130 IFTY=2THENUM=UM+CC%(0,1):GOSUB17230:GOTO13150
13140 PM=PM+CC%(0,1):GOSUB17230
13150 GOSUB12850:GOTO14150
13160 IFTY=2THEN13190
13170 IFP<>38THEN13210
13180 PM=PM-100:PRINT"THAT COST ME #100":GOSUB17230:GOTO14150
13190 IFU<>38THEN13210
13200 UM=UM-100:PRINT"THAT COST YOU #100":GOSUB17230:GOTO14150
13210 IFTY=2THEN13240
13220 IFP<>30THEN13250
13230 FORX=1TO5000:NEXT:GOTO12130
13240 IFU=30THENFORX=1TO5000:NEXT:GOTO12130
13250 IFTY=2ANDU=200RU=100RU=0)THEN14150
13260 IFTY=1ANDP=200RP=100RP=0)THEN14150
13270 IFTY=2THEN13750
13280 IFB%(P,8)=1ORB%(P,10)=1THEN14150
13290 IFB%(P,8)=0THEN13510
13300 IF((P-5)/10)<>INT((P-5)/10)THEN13370
13310 Z=0:FORX=0TO3:O=(X*10)+5
13320 IFB%(O,8)=2THENZ=Z+1
13330 NEXT
13340 PM=PM-(25*(2↑(Z-1))):UM=UM+(25*(2↑(Z-1)))
13350 PRINT"THAT COST ME #";(25*(2↑(Z-1))):GOSUB17230:GOTO14150
13360 GOTO14150
13370 IFP<>12ANDP<>28THEN13430
13380 IFB%(12,8)=2ANDB%(28,8)=2THENX=10:GOTO13400
13390 X=4
13400 IFB%(P,10)=0THENPM=PM-(T*X):UM=UM+(T*X)
13410 IFM%(P,10)=0THENPRINT"THAT COST ME #";(T*X):GOSUB17230:GOTO14150
13420 STOP
13430 IFB%(P,9)>0THEN13490
13431 X=1:FORXX=0TO39
13440 IFB%(XX,11)=B%(P,11)ANDB%(XX,8)<>20RB%(XX,9)>0)THENX=0
13450 NEXT
13460 X=X+1
13470 PM=PM-(X*(B%(P,2))):UM=UM+(X*(B%(P,2)))
13480 PRINT"THAT COST ME #";(X*(B%(P,2))):GOSUB17230:GOTO14150
13490 Y=B%(P,2+B%(P,9)):PRINT"THAT COST ME #"Y:UM=UM+Y:PM=PM-Y:GOSUB17230:GOTO1
4150
13510 REM
13570 IFPL<1THEN13670
13571 O=P:01=0:GOSUB35000:IF03=0THEN13670
13580 B%(P,8)=1:PM=PM-B%(P,0)
13590 PRINT"I'VE BOUGHT ";D$(P):GOSUB17230
13600 GOTO14150
13670 IFUL<1THEN14150
13680 PRINT"I DON'T WANT "D$(P):PRINT"DO YOU WANT TO BUY ";D$(P):PRINT"(Y-N-H)?
"
13690 GOSUB18440:IFA$="Y"THEN13730
13700 IFA$="H"THENGOSUB14140:N7=0:GOTO13680
13710 IFA$="N"THEN14160
13720 GOTO13690
13730 UM=UM-B%(P,0):B%(P,8)=2:GOSUB17230
```

(listing continued on page 121)



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"Picture shows 1600s fitted with tractor feed option"

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AUTO BIDIRECTIONAL	Yes	No	No	No	**Yes**
AUTO LOGIC SEEKING	Yes	No	Yes	No	**Yes**
PROPORTIONAL PRINT CAPABILITY	Yes	Yes	Yes	No	**Yes**
EXTENDED CHARACTER SET	No	No	Yes	Yes	**Yes**
LETTER QUALITY PRINT	Yes	Yes	Yes	Yes	**Yes**
CUSTOM INTER-FACE OPTION	No	No	No	No	**Yes**
PRICE	£1675	£1950	£1950	£1450	**£1450**

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Lots. HAWK designers, with extensive experience from the main frame and mini-computer fields, were upset by the lack of security features on micros being sold for business use, where data corruption can have disastrous consequences. HAWK has an impressive–if not unique–set of devices designed to help you sleep at night.

3 WAY KEYSWITCH

To prevent unauthorized usage of the computer this switch can also disable the reset button to avoid accidental program crashes.

OPERATING STATUS MONITOR

Special hardware and software lights a "Run Light" on the front console when the system is operating normally.

RESET BUZZER

This tells you when the reset has been pressed whilst it is enabled.

DISKETTE DRIVE INTERLOCK

HAWK will not let you switch off whilst a diskette is loaded, thus avoiding accidental disc corruption.

CONTINUOUSLY RUNNING SELF-DIAGNOSTICS

In "Background" mode, these micro programs continuously monitor the health of the system and log failures, often long before the user would otherwise detect problems.

DIAGNOSTIC MICROPROGRAMS

Built into the "Bootstrap" PROM and therefore not dependent upon correct disk operations, you or your service engineer, can quickly diagnose the problem area in the unlikely event of system failure.

SWITCHED MAINS OUTLETS

Switching off the HAWK can also automatically remove power from your VDU and printer.

HIGH RELIABILITY

HAWK designers have carefully selected top quality components to minimise the risk of breakdown.

1 YEAR GUARANTEE

Because of the high reliability built in, HAWK can offer a 1 year, return to factory, guarantee.

SWITCH MODE POWER SUPPLY

This caters for the kind of dirty and variable mains often found in industrial environments. HAWK has been successfully tested on the same circuit as, and adjacent to, electric arc welding (one of the worst sources of problems) and can even survive thunderstorms where the lights will visibly dim.

METAL CASE

This provides both strength and style and gives electrical screening to minimise interference.

It is an unobtrusive 5.1" x 17" x 17.1".

AND WHAT ISN'T?

HAWK's designers considered several 8 and 16 bit mpu chips and chose the 4MHz Z 8 φA because of the vast range of available applications software and perfectly adequate processing speed. This is coupled with a minimum of 66K bytes memory (expandable to 288K), the industry standard CP/M* 2.2 and disc storage (floppy and/or hard) from 780K bytes to over 25M bytes.

THE PRICE

HAWK, with all its valuable extra features, costs no more than the majority of comparable systems without them.

DEALERS

To give adequate local support, HAWK is sold through dealers. There are still opportunities in some areas for suitably experienced companies to be appointed as HAWK dealers. Please contact John Spencer at HAWK

FOR FURTHER DETAILS

Please 'phone or write to the Sales Department at the address shown below or contact your nearest HAWK dealer.

• Circle No. 179

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"BUILT UP TO A STANDARD NOT DOWN TO A PRICE"

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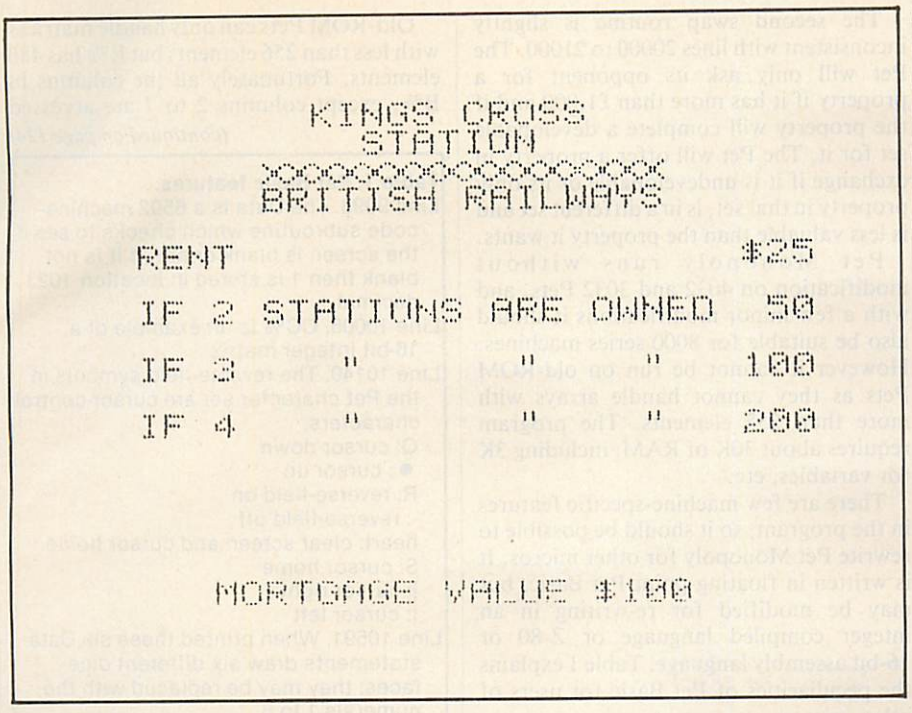


(continued from page 116)

own or a swap for a similar property. If the player wants a property which is not owned by the computer then the swap is blocked by line 20100. The computer then sets up Q2 as in line 30000.

If the property being offered by the player will not complete a set for the computer, or if the computer is giving away a property from a complete set, then line 20140 blocks the swap. If the Pet has less than £1000 the deal is blocked by line 20150.

The swap routine is rather too strict. For example, the first condition in line 20090 should only apply if the player is going to receive a complete developable set and has enough cash to put houses on that set. Ideally the two swap routines should be completely rewritten and replaced with routines capable of handling swaps involving more than one property and cash as well. Unfortunately, this proved very difficult as there is only about 1K of RAM left on a 32K Pet.

The swap routine in lines 16760 to 17180 is more complicated. The computer goes through each set of developable property and looks to see if the player owns the one property needed to complete a set for the Pet. If it finds one the computer offers the player its less-valuable properties in exchange. The routine is further complicated by the way it has been translated into Basic: to ensure that the computer will only ask to swap a property if it has something to offer in exchange, all the computer's decisions are made before it prints anything on the screen.

If the human player does not want to swap, or if it is not the Pet's turn, or if the Pet has less than £1,000, then line 16760 bypasses the swap routine. In line 16810, A9 is 1 greater than the set number which the computer tried to swap last time. So if the computer is interested in swapping more than one property, it will ask to swap the desired properties in rotation. The loop X goes through all the sets of properties as the Pet looks for a set it is interested in.

The Pet never wants a station or a utility from you, and it is avoided by line 16820.

(continued on next page)

(listing continued from page 116)

```
13740 GOTO14150
13750 IFBX(U,8)=20RBX(U,10)=1THEN14150
13760 IFBX(U,8)=0THEN13950
13770 IF((U-5)/10)<>INT((U-5)/10)THEN13830
13780 Z=0:FORX=0TO3:O=(X*10)+5
13790 IFBX(O,8)=1THENZ=Z+1
13800 NEXT
13810 UM=UM-((2↑(Z-1))*25):PM=PM+((2↑(Z-1))*25)
13820 PRINT"THAT COST YOU $";((2↑(Z-1))*25):GOSUB17230:GOTO14150
13830 IFU<>12ANDU<>28THEN13870
13840 IFBX(12,8)=1ANDBX(28,8)=1THENX=10:GOTO13860
13850 X=4
13860 UM=UM-(T*X):PM=PM+(T*X):PRINT"THAT COST YOU $";T*X:GOSUB17230:GOTO14150
13870 IFBX(U,9)>0THENY=BX(U,BX(U,9)+2):PRINT"THAT COST YOU $"Y:PM=PM+Y:UM=UM-Y:
GOSUB17230
13871 IFBX(U,9)>0THEN14150
13872 X=1:FORXX=0TO39
13880 IFBX(XX,11)=BX(U,11)ANDBX(XX,8)<>10RBX(XX,9)>0)THENX=0
13890 NEXTXX
13900 X=X+1
13910 UM=UM-(X*(BX(U,2))):PM=PM+(X*(BX(U,2)))
13920 PRINT"THAT COST YOU $";(X*(BX(U,2))):GOSUB17230:GOTO14150
13950 IFUL<1THEN14030
13960 PRINT"DO YOU WANT TO BUY ";D$(U):PRINT"(Y-N-H)?";
13970 GOSUB18440:IFA$="Y"THENPRINT:GOTO14120
13980 IFA$="H"THENGOSUB14140:N7=0:GOTO13960
13990 IFA$<>"N"THEN13970
14000 PRINT"N":O=U:O1=1:GOSUB35000:IF03=0THEN14041
14030 IFPL<1THEN14150
14040 GOTO14070
14041 PRINT"I DON'T WANT IT EITHER":FORX=1TO3E3:NEXT:GOTO14150
14070 BX(U,8)=1:PM=PM-BX(U,0):PRINT"I'VE BOUGHT IT":GOSUB17230
14090 GOTO14150
14120 BX(U,8)=2:UM=UM-BX(U,0):GOSUB17230:GOTO14150
14140 N7=1:GOTO14160
14150 SYS826:IFPEEK(1023)=1THENFORX=1TO4000:NEXT
14160 POKE158,0
14170 PRINT"■■■■■■COMMAND■■■■■■■■■■■■■■■■PRESS"
14180 PRINT"■■■■[          ]■■■■■■■■■■■■■■■■[          ]"
14190 PRINT"■■■■LIST OF YOUR PROPERTY"
14200 PRINT"■■■■LIST OF MY PROPERTY"
14210 PRINT"■■■■LIST UN-OWNED PROPERTY"
14220 PRINT"■■■■BUY HOUSES"
14230 PRINT"■■■■SEE CASH"
14240 PRINT"■■■■SEE BOARD"
14250 PRINT"■■■■SEE A CARD"
14260 PRINT"■■■■MORTGAGE"
14270 PRINT"■■■■GET OUT OF JAIL"
14280 PRINT"■■■■UNMORTGAGE"
14290 PRINT"■■■■SELL HOUSES"
14300 PRINT"■■■■END GAME"
14310 PRINT"■■■■SAVE GAME"
14315 PRINT"■■■■SWAP PROPERTY"
14320 PRINT"■■■■CHANGE YOUR OPTIONS"
14322 PRINT"■■■■SPEED UP GAME"
14330 PRINT"■■■■CONTINUE                ■SPACE■"
14331 PRINTTAB(23)"OR ■SHIFT■"
14332 PRINT"■■■":FORX=1TO16:PRINTTAB(28);MID$(II$,X,1):NEXT
14340 PRINT"■■■■■■TYPE IN YOUR CHOICE■"
14350 IFPEEK(152)=0THENGETA$:IFA$=""THEN14350
14355 IFA$="  "ORPEEK(152)=1THENPRINT"□":GOTO16100
14360 PRINT"□":IFA$<>"Y"THEN14460
14365 GOSUB14370:GOTO14430
14370 FORX=0TO39
14380 IFBX(X,8)<>2THEN14420
14390 PRINTX;D$(X);
14400 IFBX(X,10)=1THENPRINT" MORTGAGED";
14410 PRINT
14420 NEXT:RETURN
14430 PRINT"■■PRESS ANY KEY TO CONTINUE■"
14440 GETA$:IFA$=""THEN14440
14450 GOTO14160
14460 IFA$<>"F"THEN14560
14465 GOSUB14470:GOTO14530
14470 FORX=0TO39
14480 IFBX(X,8)<>1THEN14520
14490 PRINTX;D$(X);
14500 IFBX(X,10)=1THENPRINT" MORTGAGED";
14510 PRINT
14520 NEXT:RETURN
14530 PRINT"■■PRESS ANY KEY TO CONTINUE■"
14540 GETA$:IFA$=""THEN14540
14550 GOTO14160
14560 IFA$<>"$"THEN14580
14570 PRINT"I HAVE $"PM" YOU HAVE $"UM:GOTO14150
14580 IFA$<>"B"THEN14600
14590 GOSUB11161:GOTO14160
14600 IFA$<>"C"THEN15480
14610 PRINT"□WHICH ONE DO YOU WANT TO SEE?":GOSUB14620:GOTO14740
14620 PRINT" 0 ■NONE■  ":Z=0:FORX=0TO39
14630 IFBX(X,11)>0THEN14710
14640 IFZ=0THEN14680
14650 IFLEN(D$(X))>15THENZ=0:PRINT:GOTO14680
14660 PRINTX;"■■";D$(X)
14670 Z=0:GOTO14710
14680 PRINTX;"■■";D$(X);
14690 IFLEN(D$(X))>14THENZ=0:PRINT:GOTO14710
14700 Z=1
14710 NEXT
14720 PRINT"■";TAB(28);:INPUTA
14730 RETURN
14740 IFA=0THEN14160
14750 IFA<>12ANDA<>28THEN14970
14760 PRINT"□"
14770 FORX=0TO4:PRINT"■■■■■                                    ■":NEXT
14780 PRINT"■■■";SPC(14);"■TITLE DEED"
14790 PRINTTAB(7);:IFA=12THENPRINTSPC(4);:GOTO14810
14800 PRINTSPC(6);
14810 PRINT"■";D$(A)
14820 IFA=12THENFORX=32937TO32956:POKEX,170:NEXT:GOTO14840
14830 FORX=32938TO32954:POKEX,170:NEXT
14840 PRINT"■■";:FORX=1TO17:PRINT"■■■■■  ■";SPC(25);"■  ■":NEXT
14850 PRINT"■■■■■■■■";TAB(18)
14860 IFA=12THENPRINT"□┌─┐■■■■┤◆├■■■■┐■ ■"■":GOTO14880
14870 PRINT"□├┬┬■■■┴─┴■■■■┬┬┤■"
14880 PRINTTAB(8);"IF ONE 'UTILITY' IS"
14890 PRINT"■■■■■■■■OWNED,RENT IS 4 TIMES"
14900 PRINT"■■■■■■■■AMOUNT SHOWN BY DICE."
14910 PRINT"■■■■■■■■IF BOTH 'UTILITIES' ARE"
14920 PRINT"■■■■■■■■OWNED,RENT IS 10 TIMES"
14930 PRINT"■■■■■■■■AMOUNT SHOWN ON DICE."
14940 PRINT"■■■■■■■■■■■■■■MORTGAGE VALUE $75"
```

(listing continued on next page)

(continued from previous page)

If the player has the one property that will complete set X for the Pet then line 16830 sends it to line 16900. Line 16900 finds the player's property in set X which the Pet wants, and line 16970 looks for any properties which the Pet is willing to offer in exchange for Y. If the computer is willing to give away a property then Q3(n), where n is the number of the property is set to 1; K9 is set to 1 if the Pet finds at least one property it is willing to offer the player.

If the Pet is willing to offer a property to the human, line 16970 ensures that it belongs to the computer and is undevelopable. It then checks the property further: line 16980 checks that it belongs to the Pet; line 16990 establishes that it is the only one in the set which belongs to the computer; line 17000 checks that it is less valuable than the property which the Pet wants and does not belong to the same set as the property which it wants; finally line 17010 ensures it is not part of a complete set. If the Pet has found no suitable properties to offer its opponent then line 17050 makes the jump to the end of the routine.

Line 17060 tells the player which property the Pet wants and what it is willing to offer in exchange, and line 17140 checks that the opponent has selected one of the properties on offer. Line 17150 implements the deal, and the computer unmortgages its new property if necessary.

The second swap routine is slightly inconsistent with lines 20000 to 21000. The Pet will only ask its opponent for a property if it has more than £1,000 and if the property will complete a developable set for it. The Pet will offer a property in exchange if it is undevelopable or its only property in that set, is in a different set and is less valuable than the property it wants.

Pet Monopoly runs without modification on 4032 and 3032 Pets, and with a few minor modifications it should also be suitable for 8000 series machines. However it cannot be run on old-ROM Pets as they cannot handle arrays with more than 255 elements. The program requires about 30K of RAM, including 3K for variables, etc.

There are few machine-specific features in the program, so it should be possible to rewrite Pet Monopoly for other micros. It is written in floating-point Pet Basic, but may be modified for re-writing in an integer compiled language or Z-80 or 16-bit assembly language. Table 1 explains the peculiarities of Pet Basic for users of other micros.

The most frequently referenced variable is B% a 40-by-12 integer matrix which stores the data on each square of the board. Each of the 40 rows corresponds to one square on the board: row 0 is GO, row 1 is Old Kent Road, row 2 is Community Chest, etc — see lines 10210 to 10590. The columns contain the information on each of the 40 squares shown in table 2.

Old-ROM Pets can only handle matrices with less than 256 elements but B% has 480 elements. Fortunately all the columns in B%, except columns 2 to 7 are accessed

(continued on page 124)

Table 1. Pet Basic features.

Line 9998. The Data is a 6502 machine-code subroutine which checks to see if the screen is blank or not. If it is not blank then 1 is stored in location 1023 decimal.

Line 10005. CC% is an example of a 16-bit integer matrix.

Line 10140. The reverse-field symbols in the Pet character set are cursor-control characters:
Q: cursor down
●: cursor up
R: reverse-field on
-: reverse-field off
heart: clear screen and cursor home
S: cursor home
]: cursor right
|: cursor left

Line 10591. When printed these six Data statements draw six different dice faces; they may be replaced with the numerals 1 to 6.

Line 10600. The non-alphabetic characters in these data statements are control characters each representing an English word — see lines 10980 to 11055. The non-alphabetic characters are shifted a,b,c,d, and e. Unfortunately, on a printer shift c,d and e all appear as horizontal lines so it is necessary to

(listing continued from previous page)

```
14950 FORX=33535TO33561:POKEX,160:POKEX+120,160:NEXT
14960 GOTO15420
14970 IF((A-5)/10)<>INT((A-5)/10)THEN15150
14980 PRINT"□"
14990 FORX=32814TO32840:POKEX,99:POKEX+840,100:NEXT
15000 FORX=32853TO32853+760STEP40:POKEX,101:POKEX+28,103:NEXT
15010 POKE32813,79:POKE32841,80:POKE33653,76:POKE33681,122
15020 PRINT"■■";
15030 F$=LEFT$(D$(A),LEN(D$(A))-8)
15040 PRINTSPC((19-LEN(F$))/2);
15050 PRINTF$:PRINTTAB(15);"STATION"
15060 PRINTTAB(11);"XXXXXXXXXXXXXXXX"
15070 PRINTTAB(11),"BRITISH RAILWAYS"
15080 PRINT"■■■■■■■RENT";SPC(20);"$25"
15090 PRINT"■■■■■■■IF 2 STATIONS ARE OWNED■■50"
15100 PRINT"■■■■■■■IF 3";SPC(20);"100"
15110 PRINT"■■■■■■■IF 4";SPC(20);"200"
15120 PRINT"■■■■■■■■■■■■■MORTGAGE VALUE $100"
15130 FORX=0TO80STEP80:POKE33262+X,34:POKE33269+X,34:POKE33274+X,34:NEXT
15140 GOTO15420
15150 IFB%(A,11)=0THENPRINT"I DON'T KNOW THAT ONE":GOTO14610
15160 PRINT"□" FORX=32813TO33633STEP40:POKEX,150:POKEX+1,150:POKEX+27,160:POKEX
-28,150:NEXT
15170 FORX=32813TO32841:POKEX,160:POKEX+160,150:POKEX+520,150:POKEX+560,160:POK
EX+840,160
15180 POKEX+40,160:POKEX+80,160:POKEX+120,160:NEXT
15190 PRINT"■":TAB(14);"■TITLE DEED■"
15200 PRINTTAB(18-INT(LEN(D$(A))/2));"■";D$(A);"■"
15210 PRINTTAB(18-INT(LEN(D$(A))/2));"■";
15220 FORX=1TOLEN(D$(A)):PRINTMID$(WE$,B%(A,11),1);:NEXT:PRINT"■■"
15230 PRINT"■■■■■■■■RENT■SITE ONLY■■■■■■■";
15240 IFB%(A,2)<10THENPRINT" ";
15250 PRINT"$";B%(A,2)
15260 PRINTTAB(13);"WITH 1 HOUSE■■■";
15270 IFB%(A,3)<100THENPRINT"■";
15280 PRINTB%(A,3)
15290 PRINTTAB(18);"2 HOUSES■■";: IFB%(A,4)<100THENPRINT"■";
15300 PRINTB%(A,4)
15310 PRINTTAB(18);"3 HOUSES■";: IFB%(A,5)<100THENPRINT"■■";:GOTO15330
15320 IFB%(A,5)<1000THENPRINT"■";
15330 PRINTB%(A,5)
15340 PRINTTAB(18);"4 HOUSES■";: IFB%(A,6)<1000THENPRINT"■";
15350 PRINTB%(A,6)
15360 PRINTTAB(18);"HOTEL■■■■";: IFB%(A,7)<1000THENPRINT"■";
15370 PRINTB%(A,7)
15380 PRINT"■■■■■■■■■■■COST OF HOUSES $";B%(A,1);"EACH"
15390 PRINTTAB(15);"HOTELS=$";B%(A,1);"PLUS"
15400 PRINTTAB(23);"4 HOUSES"
15410 PRINTTAB(8),"MORTGAGE VALUE $";(B%(A,0)/2)
15420 IFB%(A,10)=1THENPRINT"■■■■■■■■■■■■■■■■■MORTGAGED■■"
15430 PRINT"■■ANY";:PRINT"MORE?";:PRINT"(Y-N)"
15440 GETA$:IFA$=""THEN15440
15450 IFA$="Y"THEN14610
15460 IFA$="N"THEN14160
15470 GOTO15440
15480 REM
15490 IFA$<>"M"THEN15620
15500 PRINT"□WHICH ONE DO YOU WANT TO MORTGAGE"
15510 GOSUB18630:IFA=0THEN14160
15520 IFB%(A,8)<>2THENPRINT"□YOU DON'T OWN IT":GOTO15610
15530 IFB%(A,10)=1THENPRINT"IT'S ALREADY MORTGAGED":GOTO15610
15540 B%(A,10)=1:UM=UM+((((B%(A,9)*B%(A,1))+B%(A,0))/2))
15550 B%(A,9)=0
15560 PRINT"□ANY MORE (Y-N)?"
15570 GETA$:IFA$=""THEN15570
15580 IFA$="Y"THEN15500
15590 IFA$="N"THEN14160
15600 GOTO15570
15610 GOTO14150
15620 IFA$<>"U"THEN15740
15630 PRINT"□WHICH ONE DO YOU WANT TO UN-MORTGAGE"
15640 GOSUB18710:IFA=0THEN14160
15650 IFB%(A,8)<>2THENPRINT"IT'S NOT YOURS!":GOTO15630
15660 IFB%(A,10)=0THENPRINT"IT'S NOT MORGAGED":GOTO15630
15670 UM=UM-(B%(A,0)*0.55)
15680 B%(A,10)=0:PRINT"□":GOSUB17230
15690 PRINT"ANY MORE (Y-N)?"
15700 GETA$:IFA$=""THEN15700
15710 IFA$="Y"THEN15630
15720 IFA$="N"THEN14160
15730 GOTO15700
15740 IFA$<>"0"THEN15810
15750 IFUA>0THEN15770
15760 PRINT"YOU'RE NOT IN JAIL":GOTO15610
15770 PRINT"YOU'RE FREE"
15780 IFCJ=2THENCJ=0:UA=0:GOTO14150
15790 IFHJ=2THENHJ=0:UA=0:GOTO14150
15800 UM=UM-50:UA=0:GOSUB17230:GOTO14150
15810 IFA$<>"E"THEN15960
15820 PRINT"DO YOU REALY WANT TO END THIS LOVELY    GAME (YES-NO)";
15830 INPUTA$:IFA$="NO"THEN14160
15840 IF A$="YES"THENPRINT"YOU'RE SCARED I'LL BEAT YOU!!":GOTO15860
15850 GOTO15820
15860 UV=UM:PV=PM
15870 FORX=0TO39:IFB%(X,8)=0THEN15910
15880 IFB%(X,8)=2THEN15900
15890 PV=PV+((B%(X,0)/((B%(X,10)+1)))+(B%(X,9)*B%(X,1))):GOTO15910
15900 UV=UV+((B%(X,0)/((B%(X,10)+1)))+(B%(X,9)*B%(X,1))):GOTO15910
15910 NEXT
15920 PRINT"I'VE GOT $";PV;" YOU'VE GOT $";UV
15930 IFUV=PVTHENPRINT"IT'S A DRAW":END
15940 IFUV>PVTHENPRINT"WELL DONE HUMAN!":END
15950 PRINT"HARD LINES YOU WERE BEATEN BY A MERE PET":END
15960 IF A$<>"S"THEN16090
15970 PRINT"□WHERE DO YOU WANT TO SELL THE HOUSES"
15980 GOSUB18780:IFA=0THEN14160
15990 IFB%(A,8)<>2THENPRINT"□THEY'RE NOT YOURS TO SELL":GOTO14150
16000 PRINT"□IT HAS ";B%(A,9);" HOUSES"
16010 INPUT"HOW MANY DO YOU WANT TO SELL";X
16020 IFX<0ORX>B%(A,9)THEN15970
16030 B%(A,9)=B%(A,9)-X:UM=UM+(X*B%(A,1)*.5)
16040 PRINT"ANY MORE (Y-N)?"
16050 GETA$:IFA$=""THEN16050
16060 IFA$="Y"THEN15970
16070 IFA$="N"THEN14160
16080 GOTO16050
16090 IFA$<>"I"ANDPEEK(152)=0THEN16120
16100 IFN7=0THEN16320
16110 RETURN
16120 IFA$<>"H"THEN16300
16130 PRINT"□WHERE DO YOU WANT TO PUT THE HOUSES":GOSUB18540:IFA=0THEN14160
16140 IFB%(A,1)=0THEN16130
```

specify each Data statement:
10600 is a shift-e followed by a shift-b
10610 is a,d
10720 is c
10730 is b
10750 is e
10800 is b
10820 is b
10860 is b
10870 is a
10880 is a
10910 is e
10980 and 10990 are shift-a
11000 and 11010 are b
11020 and 11030 are c
11040 and 11050 are d
11054 and 11055 are e

Lines 11070 to 11150. These are the first section of the program concerned with saving the variables on tape or disc. They are not essential to the program and may be omitted. The only advantage of these sections is that they allow a user to save a particular game of Monopoly on tape or disc and resume play at a later date. Other parts of the program which load and save data on tape or disc are 17780 to 17980, and 19090 to 19270.

Lines 11160 to 11410. These statements print out the board. You may choose your own board to suit your computer.

Line 11170. This clears the input buffer of all characters.

Line 11770. For Get A$ see Line 14350.

Lines 11480 to 11570; 11630 to 11780. These important statements display the position of the player and the Pet stored in U and P and the number of houses on each property stored in B%(n,9), where n is the number of the property.

Line 11590. X7 and Y7 are set to integer random numbers from 1 to 6 inclusive.

Lines 11810 and 11850. Z is set to an integer random number 0 to 15 inclusive.

Line 12030. Sys826 calls the machine-code subroutine described in statement 9998.

Line 14332. MID$(II$,X,1) is the single letter at position X with II$. Statements 14332 and 9997 were added in order to save a few bytes of memory: they can be deleted and replaced with
14190 LIST OF YOUR PROPERTY Y etc.

Line 14350. On a Pet location 152 is set to 1 if the Shift or Shift Lock key is held down, so if Shift Lock is held down then the game will keep playing automatically until the computer needs to ask the player an important question.

Line 14350. Get A$ will put the first character in the input buffer into A$. If no keys have been pressed then A$ will be set to "", null string.

Lines 14610 to 15470. This section of the program prints out the title deed cards using the Pet's limited graphics. The statements are not essential since a player can easily use the title deed cards from a conventional Monopoly set.

Lines 17867 to 17990. These statements read a file which contains all the essential variables in the program. This section of the program is designed for a 4032 or 3032 Pet with a Commodore 3040 or 4040 dual floppy-disc drive. All these files are cassette compatible but are much slower than disc files. If you decide to write your own variable-storing routine then copy the list of essential variables which need to be saved.

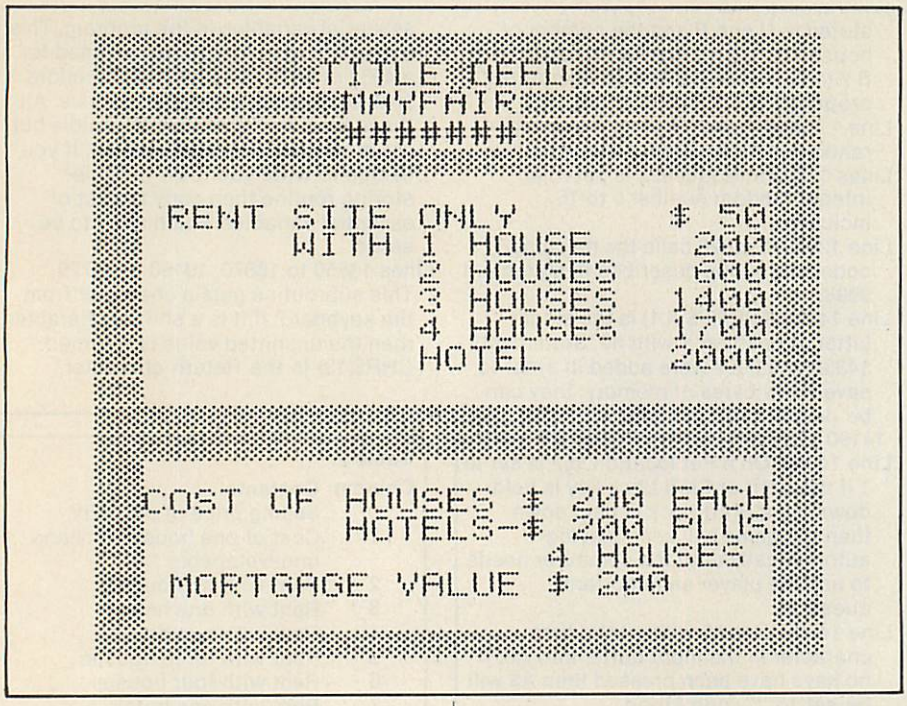
Lines 18850 to 18870, 19160 to 19720. This subroutine gets a character from the keyboard; if it is a shifted character then the unshifted value is returned. CHR$(13) is the Return character.

Table 2.

Column	Contents
0	Selling price of porperty
1	Cost of one house; 0 means undevelopable
2	Rent with no houses
3	Rent with one house
4	Rent with two houses
5	Rent with three houses
6	Rent with four houses
7	Rent with one hotel
8	Owner: 0, unowned; 1, owned by Pet; 2, owned by player
9	Number of houses on property; 5 represents hotel
10	Mortgaged or not: 1, mortgaged; 0, not mortgaged
11	Set number: 1, Old Kent Road and Whitechapel; 3, Angel, Euston and Pentonville; etc.

```
16150 X=B%(A,11):Y=1
16160 FORXX=0TO39:IFB%(XX,11)<>XTHEN16180
16170 IFB%(XX,8)<>2ORB%(XX,10)=1THENY=0
16180 NEXT
16190 IFY=0THENPRINT"□YOU CAN'T DO THAT":RT=1:GOTO14150
16200 PRINT"□"D$(A)" HAS "B%(A,9)" HOUSES":PRINT"HOW MANY MORE DO YOU WANT",
16210 INPUTX:IFX+B%(A,9)>5THENPRINT"□THAT'S TOO MANY":FORX=1TO3E3:NEXT:GOTO1520
0
16220 IFX<0ORX<>INT(X)THEN16200
16230 B%(A,9)=B%(A,9)+X:UM=UM-(B%(A,1)*X):GOSUB17230
16240 REM QWERTYS ARE HAPPY
16250 PRINT"ANY MORE (Y-N)?"
16260 GETA$:IFA$=""THEN16260
16270 IFA$="Y"THEN16130
16280 IFA$="N"THEN14160
16290 GOTO16260
16300 IFA$<>"*"THEN19010
16310 GOSUB19260:GOTO14150
16320 GOTO16760
16330 IF04(2)=0THEN16440
16340 FORX=1TO10:O2(X,0)=9:O2(X,1)=0:NEXT
16350 FORX=0TO39:IFB%(X,1)=0THEN16380
16360 IFB%(X,9)>O2(B%(X,11),1)THENO2(B%(X,11),1)=B%(X,9)
16370 IFB%(X,9)<O2(B%(X,11),0)THENO2(B%(X,11),0)=B%(X,9)
16380 NEXT
16390 FORZZ=1TO10:IFZZ=20RZZ=5THEN16410
16400 IFO2(ZZ,1)-O2(ZZ,0)>1THEN16480
16410 NEXT
16440 IFDO>0THEN11300
16450 TY=(TY*-1)+3
16460 REM
16470 DO=0:GOTO11300
16480 PRINT"□THE HOUSES ON SET"ZZ"ARE IRREGULAR"
16490 FORXX=0TO39:IFB%(XX,11)=ZZTHENPRINTXX;D$(XX)
16500 NEXTXX
16510 SYS826:IFPEEK(1023)=1THENFORX=1TO5000:NEXT
16511 GOTO14150
16520 GOTO16600
16530 Z=0:FORX=0TO39:IFB%(X,8)=1ANDB%(X,10)=1THENZ=1
16540 NEXT
16550 IFZ=0ORPM<600THEN16330
16560 GOSUB30000:FORX=0TO39:IFB%(X,8)<>1ORB%(X,10)=0THEN16565
16561 IFO2(B%(X,11),0)=0ANDO2(B%(X,11),2)=0THEN16580
16565 NEXT
16569 FORX=0TO39:IFB%(X,8)=1ANDB%(X,10)=1THEN16580
16570 NEXTX
16580 B%(X,10)=0:PRINT"I'VE UNMORTGAGED ";D$(X):PM=PM-(B%(X,0)*.55)
16590 GOSUB17230:FORY=1TO3000:NEXT:GOTO16520
16600 REM PRINT"□"
16610 REM
16620 F1=1:FORX=1TO10:O1(X)=0:NEXT
16630 FORX=1TO39:IFB%(X,8)<>1ORB%(X,1)=0ORB%(X,10)=1ORB%(X,9)=5THENO1(B%(X,11))
=1
16640 NEXTX
16650 FORN=1TO10:IFO1(N)=0THENF1=0:GOTO16680
16660 REM
16670 NEXTN:IFF1=0THEN16330
16671 GOTO16530
16680 FORXX=0TO39:IFN=B%(XX,11)THEN16700
16690 NEXTXX
16700 IF(PM-(B%(XX,1)*3))<350THEN16670
16710 FORQ=0TO39:IFB%(Q,11)=NANDB%(Q,10)=1THEN16670
16720 NEXT
16730 FORY=XXTO39:IFN=B%(Y,11)THEN16750
16740 NEXTY:FORX=1TO1000:NEXT:GOTO16610
16750 PM=PM-B%(Y,1):B%(Y,9)=B%(Y,9)+1:PRINT"I'VE PUT A HOUSE ON ";D$(Y):GOTO167
40
16760 IF04(1)=0ORTY<>10RPM<1000THEN17190
16770 GOSUB30000
16810 FORX=A9TO10
16820 IFX=20RX=5THEN16840
16830 IFO2(X,0)=0ANDO2(X,2)=1THEN16900
16840 NEXT
16850 FORX=1TOR9
16860 IFX=20RX=5THEN16880
16870 IFO2(X,0)=0ANDO2(X,2)=1THEN16900
16880 NEXT
16890 A9=1:GOTO17190
16900 FORY=0TO39:IFB%(Y,8)=2ANDB%(Y,11)=XTHEN16970
16910 NEXTY:STOP
16920 W7=W7-1:GOTO16940
16970 K9=0:FORZ=0TO39:O3(Z)=0:IFB%(Z,1)=0ANDB%(Z,8)=1THEN17020
16980 IFB%(Z,8)<>1THEN17050
16990 IFO2(B%(Z,11),1)>1THEN17050
17000 IFB%(Z,0)>B%(Y,0)ORB%(Z,11)=B%(Y,11)THEN17050
17010 IFO2(B%(Z,11),0)=0ANDO2(B%(Z,11),2)=0THEN17050
17020 REM
17030 O3(Z)=1:K9=1
17050 NEXTZ:IFK9=0THENPRINT"□":A=0:GOTO17130
17060 PRINT"□I WANT ";D$(Y);" WHAT DO YOU WANT□"
17070 PRINT" 0 =NONE■SWAP■"
17080 FORX3=0TO39:IFO3(X3)=1THENPRINTX3;D$(X3);
17090 IFO3(X3)=1ANDB%(X3,10)=1THENPRINT" MORTGAGED":GOTO17110
17100 IFO3(X3)=1THENPRINT
17110 NEXTX3
17120 PRINT"■":INPUTA
17130 IFA=0THENA9=X+1:GOTO17210
17140 IFO3(A)=0THENPRINT" THAT'S NOT ONE OF THEM":FORX=1TO5000:NEXT:GOTO16920
17150 PRINT"□OK!"
17160 IFB%(Y,10)=1THENPRINT"I'VE UNMORTGAGED IT"
17170 IFB%(Y,10)=1THENPM=PM-(B%(Y,0)*0.55):GOSUB17230:B%(Y,10)=0
17180 B%(Y,8)=1:B%(A,8)=2:FORX=1TO3000:NEXT
17190 PRINT"□":IFTY=1THEN16600
17200 GOTO16330
17210 IFA9>10THENA9=1:GOTO17190
17220 GOTO17190
17230 UM=INT(UM):PM=INT(PM):PRINT"I HAVE $"PM" YOU HAVE $"UM
17240 IFUM=>0THEN17380
17250 FORX=1TO4000:NEXT
17260 PRINT"□WHERE DO YOU WANT TO MORTGAGE OR TAKE  HOUSES OFF"
17270 GOSUB18630:IFA=0THENPRINT"□":GOTO17530
17280 PRINT"□";D$(A);" HAS";B%(A,9)" HOUSES"
17290 IFB%(A,8)<>2THENPRINT" YOU DON'T OWN IT":GOTO17230
17300 IFB%(A,10)=1THENPRINT"IT'S MORTGAGED":GOTO17230
17310 IFB%(A,9)<>0THEN17710
17320 PRINT"DO YOU WANT TO MORTGAGE IT (Y-N)?"
17330 GETA$:IFA$=""THEN17330
17340 IFA$="N"THEN17530
17350 IFA$<>"Y"THEN17330
17360 UM=UM+(B%(A,9)*B%(A,1)*0.5):UM=UM+(B%(A,0)/2):B%(A,9)=0:B%(A,10)=1
17370 GOTO17230
17380 REM?"□"
```

(listing continued on next page)



(continued from page 122)

individually and it may therefore be replaced with single-column 40-element, arrays. Columns 2 to 7 must be stored together in one matrix unless you adapt the statements which occur around lines 13490 and 13870.

Community Chest and Chance cards are stored in the matrices CC%, CH%, C$ and H$, which are filled by statements 11800 to 11880, using the data stored at 10600 to 10910. At the start of the game the cards are shuffled into CC% and CH% while the text for each card is read sequentially into C$ and H$.

Other important variables include:

A9 — Number of set which the computer would next like to try to swap.

UA — Your length of jail sentence remaining.

PA — Pet's length of jail sentence remaining.

CJ — Identity of the owner of the Community Chest "Get Out of Jail Free" card: 1, Pet; 2, player.

HJ — As CJ but for Chance cards.

DO — Number of successive doubles thrown by current player.

UL — Number of laps of the board completed by player.

PL — Number of laps of the board completed by Pet.

TY — Identity of player whose turn it is: 1, Pet; 2, player.

PM — Pet's money.

UM — Player's money.

Q4(1) — Set to 1 if player wishes to swap, otherwise set to 0.

Q4(2) — Set to 1 if player objects to uneven houses, otherwise set to 0.

S1 — Set to 1 to suppress the board.

S2 — Set to 1 to suppress the dice.

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(listing continued from previous page)

```
17390 IFPM<0THENRETURN
17400 REM  FORX=1TO4000:NEXT
17410 Z2=0:FORX=0TO39:IFB%(X,8)=1ANDB%(X,10)=0ANDB%(X,1)=0THEN17440
17420 NEXTX:IFZ2=0THEN17460
17430 GOTO17390
17440 B%(X,10)=1:PM=PM+(B%(X,0)\2)
17450 PRINT"I'VE MORTGAGED ";D$(X):Z2=1:GOTO17390
17460 Z3=0:FORX=0TO39:IFB%(X,8)=1ANDB%(X,10)=0ANDB%(X,9)=0THEN17490
17470 NEXTX:IFZ3=0THEN17610
17480 GOTO17390
17490 B%(X,10)=1:PM=PM+((B%(X,0)\2)
17500 PRINT"I'VE MORTGAGED ";D$(X):Z3=1:GOTO17390
17510 PRINT"I'VE GOT $";PM" YOU'VE GOT $";UM
17520 PRINT"YOU'VE WON-WELL DONE HUMAN":END
17530 IFUM>0THEN17230
17540 INPUT"DO YOU WANT TO SURRENDER (YES-NO)";A$
17550 IFA$="NO"THEN17230
17560 IFA$<>"YES"THEN17530
17570 PRINT"YOU'VE GOT $";UM" I'VE GOT $";PM
17580 PRINT"HARD LINES HUMAN"
17590 REM
17600 END
17610 Z4=0:FORXZ=0TO39:IFB%(XZ,8)=1ANDB%(XZ,10)=0THEN17630
17620 NEXTXZ:IFZ4=0THEN17510
17630 REM
17670 XP=0:FORXX=39TO0STEP-1:IFB%(XX,11)=B%(XZ,11)ANDB%(XX,9)=XPTHENXY=XX:XP=B
%(XX,9)
17680 NEXT:B%(XY,9)=B%(XY,9)-1
17690 PRINT"I'VE TAKEN 1 HOUSE OFF ";D$(XY):PM=PM+(B%(XY,1)/2)
17700 GOTO17390
17710 INPUT"HOW MANY HOUSES DO YOU WANT TO SELL";Z
17720 IFZ>B%(A,9)ORZ<>INT(Z)ORZ<0THEN17710
17730 B%(A,9)=B%(A,9)-Z:UM=UM+(Z*B%(A,1)*.5)
17740 PRINT"IT NOW HAS ";B%(A,9)" HOUSES"
17750 GOTO17320
17780 PRINT"DO YOU WANT TO START A NEW GAME OR LOAD AN OLD ONE FROM"
17790 PRINT" TAPE/DISK (N-O)?"
17800 GETA$:IFA$=""THEN17800
17810 IFA$="N"THEN18250
17820 IFA$<>"O"THEN17800
17821 FORX=0TO15:READH$(X),XX:NEXT:FORX=0TO15:READC$(X),XX:NEXT
17830 PRINT"PREPARE YOUR TAPE/DISK & PRESS A KEY"
17840 GETA$:IFA$=""THEN17840
17850 PRINT"WHAT IS THE FILE CALLED ";
17860 INPUTF$
17865 IFW6<>3ANDW6<>4THEN17870
17866 REM
17867 IFW6=3THENOPEN1,8,3,"0:"+F$+",SEQ,R":GOTO17880
17868 IFW6=4THENOPEN1,8,3,"1:"+F$+",SEQ,R":GOTO17880
17870 OPEN1,W6,0,F$
17880 FORX=0TO15:INPUT#1,CH%(X,1),CH%(X,2):NEXT
17890 FORX=0TO15:INPUT#1,CC%(X,1),CC%(X,2):NEXT:GOTO17900
17895 INPUT#1,Z:RETURN
17900 INPUT#1,P,U,W7
17910 Y=8:GOSUB17980:Y=9:GOSUB17980:Y=10:GOSUB17980
17960 INPUT#1,N7, A9,UA,PA,CJ,HJ
17965 INPUT#1,DO,UL,PL
17970 INPUT#1,TY,PM,UM,Q4(1),Q4(2),S1,S2
17975 CLOSE1:GOTO14160
17980 FORX=0TO39:INPUT#1,B%(X,Y):NEXT:RETURN
17990 REM
18100 PRINT"■■WELCOME TO PET MONOPOLY":POKE59468,12
18110 PRINT"■_____"
18140 PRINT"■WHEN THE PET ASKS YOU A QUESTION & THE  CURSOR";
18150 PRINT" APPEARS THEN TYPE IN YOUR ANSWER FOLLOWED BY ■RETURN■."
18160 PRINT"■IF IT DOES NOT APPEAR THEN JUST TYPE IN YOUR ANSWER."
18170 PRINT"■WHEN THE PET ASKS YOU A QUESTION SAMPLE ANSWERS ARE USUALLY GIVEN
IN ";
18180 PRINT"BRACKETS."
18190 PRINT"■IF IT ASKS YOU A QUESTION SUCH AS        'WHERE DO YOU WANT TO ";
18200 PRINT"MORTGAGE?' THEN   REPLY WITH A NUMBER FROM 0 TO 39 ■NOT■ THENAME ";
18210 PRINT"OF THE PROPERTY."
18211 PRINT"■IF THE PET ASKS YOU IF YOU WANT TO BUY APROPERTY AND YOU ARE ";
18212 PRINT"NOT SURE THEN TYPE IN 'H' AND THE PET WILL SHOW YOU YOUR  CARDS ET
C."
18220 PRINT"■ PRESS ANY KEY TO CONTINUE"
18225 PRINT"■"
18230 GETA$:IFA$=""THEN18230
18240 GOTO11070
18250 GOSUB18260:GOTO18320
18260 PRINT"■"
18270 PRINT"HERE ARE YOUR OPTIONS-IF YOU SAY NO TO■ THESE IT MAKES THE GAME FAS
TER."
18280 PRINT"■CAN WE SWAP THINGS (Y-N)?"
18290 Y=0:GOSUB18380
18300 PRINT"■DO YOU MIND ABOUT UN-EVEN HOUSES (Y-N)?":GOSUB18380
18310 RETURN
18320 PRINT"■■■DO YOU WANT TO BUY THINGS ON THE FIRST  ROUND (Y-N)?"
18330 GETA$:IF""=A$THEN18330
18340 IF"Y"=A$THENUL=1:PL=1:GOTO18360
18350 IFA$<>"N"THEN18330
18360 POKE158,0:INPUT"■HOW MUCH MONEY SHALL WE HAVE (USUALLY  1500)";UM
18370 PM=UM:GOTO10130
18380 POKE158,0:Y=Y+1
18390 GETA$:IFA$=""THEN18390
18400 IFA$="Y"THENQ4(Y)=1:GOTO18430
18410 IFA$="N"THENQ4(Y)=0:GOTO18430
18420 GOTO18390
18430 RETURN
18440 POKE158,0
18450 GETA$:IFA$=""THEN18450
18460 IFASC(A$)<128THEN18470
18465 A$=CHR$(ASC(A$)-128)
18470 RETURN
18480 PRINT"■ 0 ■NOWHERE■"
18490 FORX=0TO39:IFB%(X,8)<>2THEN18510
18500 PRINTX,D$(X)
18510 NEXTX
18520 PRINT"■":INPUTA:GOSUB18610:IF0=1THEN13520
18530 RETURN
18540 PRINT"■ 0 ■NOWHERE■"
18550 FORX=0TO39:IFB%(X,8)<>20RB%(X,1)=00RB%(X,10)=1THEN18570
18560 PRINTX,D$(X)
18570 NEXTX
18580 PRINT"■YOU HAVE $";UM
18590 PRINT"■":INPUTA:GOSUB18610:IF0=1THEN18590
18600 RETURN
18610 O=0:IFA<00RA>39ORA<>INT(A)THENO=1
18620 RETURN
18630 PRINT"■ 0 ■NONE■"
18640 N1=0:FORX=0TO39:IFB%(X,8)<>2ORB%(X,10)=1THEN18660
18650 PRINTX,D$(X):N1=1
18660 NEXTX
18670 PRINT"■YOU HAVE $";UM
```

(continued on page 129)

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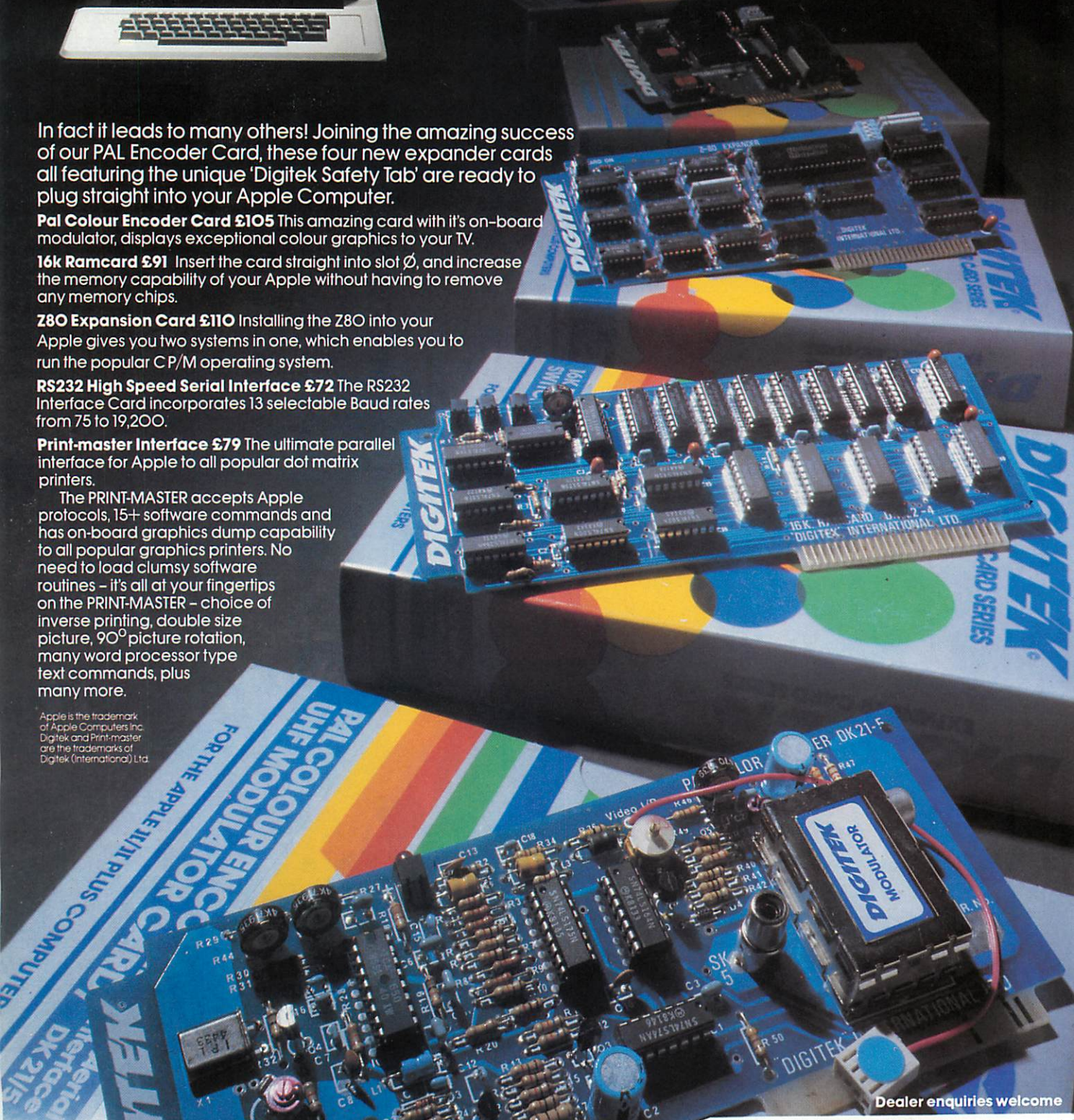

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(continued from page 124)

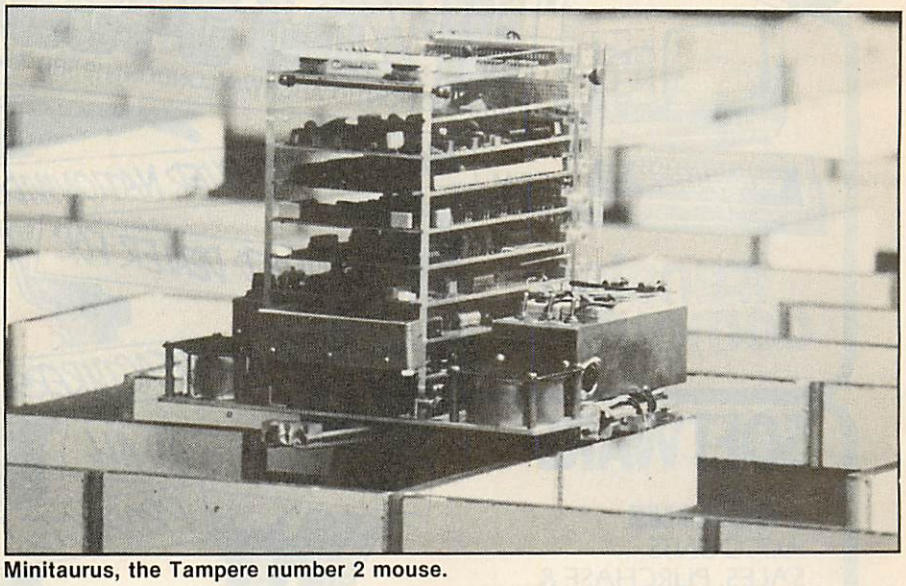
```
18680 IFN1=0THENA=0:GOTO18700
18690 PRINT"■" INPUTA:GOSUB18610:IF0=1THEN13690
18700 RETURN
18710 PRINT"■ Ø ■NONE■"
18720 FORX=0TO39:IFB%(X,8)<>20RB%(X,10)<>1THEN18740
18730 PRINTX,D$(X)
18740 NEXTX
18750 PRINT"YOU HAVE $"UM
18760 PRINT"■" INPUTA:GOSUB18610:IF0=1THEN18760
18770 RETURN
18780 PRINT"■ Ø ■NOWHERE■"
18790 FORX=0TO39:IFB%(X,8)<>20RB%(X,9)=0THEN18810
18800 PRINTX,D$(X),B%(X,9)
18810 NEXTX
18820 PRINT"■YOU HAVE $"UM
18830 PRINT"■" INPUTA:GOSUB18610:IF0=1THEN18830
18840 RETURN
18850 FORX=0TO39:IFB%(X,8)<>20RB%(X,10)<>1THEN18740
18860 IFTY=1THEN18940
18870 PRINT"□YOU'RE ON ";D$(U)
18880 IFB%(U,8)=1THENPRINT"-I OWN IT";
18890 IFB%(U,8)=2THENPRINT"-YOU OWN IT";
18900 IFB%(U,8)=0ANDB%(U,0)<>0THENPRINT"-IT'S FOR SALE FOR $";B%(U,0);
18910 IFB%(U,10)=1THENPRINT" & IT'S MORTGAGED"
18920 IFB%(U,10)=0ANDB%(U,0)<>0THENPRINT
18930 GOTO19000
18940 PRINT"□I'M ON ";D$(P)
18950 IFB%(P,8)=1THENPRINT"-I OWN IT";
18960 IFB%(P,8)=2THENPRINT"-YOU OWN IT";
18970 IFB%(P,8)=0ANDB%(P,0)<>0THENPRINT"-IT'S FOR SALE FOR $";B%(P,0);
18980 IFB%(P,10)=1THENPRINT" & IT'S MORTGAGED"
18990 IFB%(P,10)=0ANDB%(P,0)<>0THENPRINT
19000 GOSUB17230:GOTO12290
19010 IFA$<>"L"THEN19080
19020 FORX=0TO39
19030 IFB%(X,8)=0ANDB%(X,0)<>0THENPRINTX;D$(X)
19040 NEXT
19050 PRINT"■■PRESS ANY KEY TO CONTINUE■"
19060 GETA$:IFA$=""THEN19060
19070 GOTO14160
19080 IFA$<>"Y"THEN20000
19090 PRINT"DO YOU WANT TO SAVE THE GAME (YES-NO)":INPUTA$
19100 IFA$="NO"THEN14160
19110 IFA$<>"YES"THEN19090
19120 PRINT"PREPARE YOUR TAPE/DISK THEN PRESS A KEY"
19130 GETA$:IFA$=""THEN19130
19140 INPUT"WHAT SHALL I CALL THE FILE";F$
19150 PRINT"DON'T FORGET IT IS CALLED "F$
19160 REM
19165 IFW6<>3ANDW6<>4THEN19170
19167 IFW6=3THENOPEN1,8,4,"0:"+F$+",SEQ,W":GOTO19171
19168 IFW6=4THENOPEN1,8,4,"1:"+F$+",SEQ,W":GOTO19171
19170 OPEN1,W6,1,F$
19171 FORX=0TO15:PRINT#1,CH%(X,1);CHR$(13);CH%(X,2);CHR$(13);:NEXT
19180 FORX=0TO15:PRINT#1,CC%(X,1);CHR$(13);CC%(X,2);CHR$(13);:NEXT
19190 PRINT#1,P;CHR$(13);U;CHR$(13);W7;CHR$(13);
19200 Y=8:GOSUB19270
19210 Y=9:GOSUB19270
19220 Y=10:GOSUB19270
19240 PRINT#1,N7;CHR$(13);A9;CHR$(13);UA;CHR$(13);
19250 PRINT#1,PA;CHR$(13);CJ;CHR$(13);HJ;CHR$(13);
19255 PRINT#1,DO;CHR$(13);UL;CHR$(13);PL;CHR$(13);TY;CHR$(13);
19260 PRINT#1,PM;CHR$(13);UM;CHR$(13);Ø4(1);CHR$(13);Ø4(2);
19265 PRINT#1,CHR$(13);S1;CHR$(13);S2;CHR$(13);:CLOSE1:GOTO14160
19270 FORX=0TO39:PRINT#1,B%(X,Y);CHR$(13);:NEXT:RETURN
20000 IFA$<>"N"THEN25000
20005 IFØ4(1)<>1THENPRINT"□YOU CAN'T SWAP-CHANGE YOUR OPTIONS":GOTO14150
20010 PRINT"□WHAT DO YOU WANT"
20020 GOSUB14470
20030 PRINT"■■■
```

CHROMASONIC

"We will be flying at a height of 30,000 feet.
Our air speed will be 500 knots.
And there's a fair chance we're going to crash."

mice battle in Europe

No mouse claimed an easy victory at the Euromouse final in Finland recently. John Billingsley witnessed the fight for first place.



Minitaurus, the Tampere number 2 mouse.

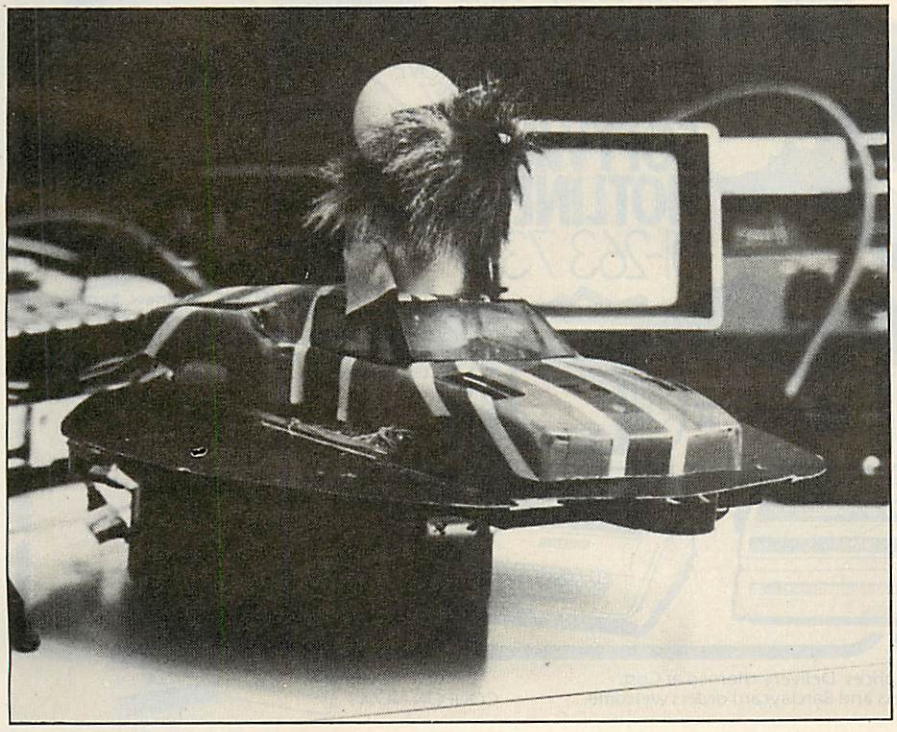
Five times in succession Thumper tried to climb out of the maze at precisely the same spot.

All traces of unconcern had disappeared when Dibley ran Thezeus 4. Supercharged to the limit, it snapped around corners with no break in speed but five times rushed headlong into trouble. At last it made a clean run of 45 seconds to the great alarm of the Finns.

Microsaurus is a 5kg. dinosaur of a mouse which took three years to build with 20 infrared sensors, four sonars and nearly a 100 semiconductors including 52 integrated circuits. Three hundred Finns held their breath as it set off, gasped when it needed a restart, and cheered deafeningly when its second run reached the centre in 47 seconds — still not fast enough. But Microsaurus has a cunning strategy: having found the shortest path it repeats the run with ever increasing speed until it uses its full 1.5 metres per second. On its first such run it needed help and the tension mounted; on seeing a clean run of 40 seconds second time round the audience erupted.

All the contestants are now the proud possessors of pine-mounted mousetraps while three generous cash prizes were given by Tampere Technical University to the winning mice. Next year's final will be held at the Madrid Euromicro Conference in September.

Thezeus 4 rushed through the maze.



Next year's British final will be held at the Computer Fair, Earls Court, June 16-18, 1983. There will be a special contest for novice mice which have never reached the centre in a national contest. Be sure to enter your mouse even if its performance is still shaky. For full details and rules of entry send a stamped addressed envelope to Micromouse, *Practical Computing*, The Quadrant, Sutton, Surrey SM2 5AS.

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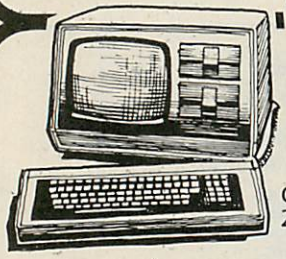

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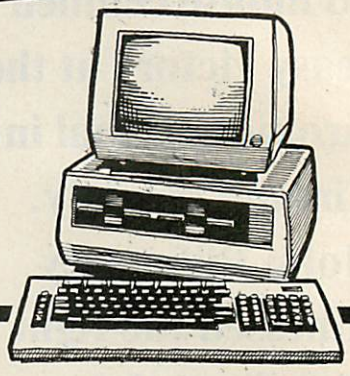

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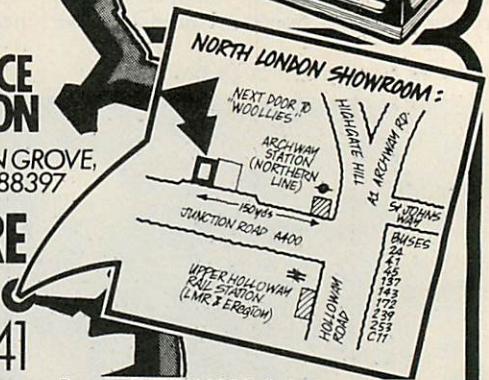

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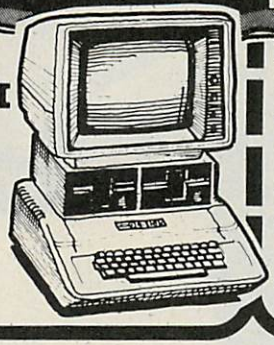

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On test: three fast-action games for the Atari 400 and 800 micros. Jack Schofield has been trying them out.

Atari arcade games

Missile Command

IF YOU ARE THINKING of buying this game, you can visit your local arcade to try it first, as Atari's Missile Command is very like the coin-slot version. The home edition even offers some enhancements which give greater control over the play.

The aim of the game is to defend six cities from destruction by ICBMs, Mirvs, killer planes and satellites, and smart bombs which home in on their targets. Attacks come in waves, and you have 30 anti-missile ABMs per wave to defend both the cities and your command post. You do this by using a joystick to position a targeting cursor in front of the incoming missile, then firing so your ABM intersects with it.

The game can be played as a one- or two-player game. In both cases the computer keeps the top score, and in the latter case it keeps two players' scores and screens separately.

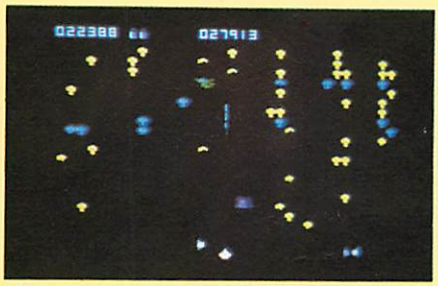
Missile Command comes as a plug-in ROM which takes only a few seconds to load. You select the number of players and by pressing keys from 1 to 9 you can skip the easier early attack waves. By pressing "s" you can restrict attacks to smart bombs only — this is for practising.

The action is reasonably quick and very smooth. Missile Command is a challenging game which requires accuracy but no great intelligence.

The 28-page, printed instruction booklet supplied with the game gives coloured screen illustrations.

Specification

Type: Arcade game; real-time with colour graphics and sound
Format: ROM cartridge CXL4012
Language: 6502 assembler
System: Atari 400 or 800 plus one or two joysticks
Minimum RAM: Not applicable
Manufacturer: Atari
Price: £29.95
Rating: 15/20



Centipede

THIS GAME is full of bugs — jumping spiders, poisonous scorpions and frenzied fleas, among others. Fortunately you are equipped with a "bug blaster" to shoot them down.

Centipede is another popular Atari coin-operated game, and many arcades have one so again you can try before you buy the ROM-cartridge version. The arcade version has the advantage of a deeper screen and more dynamic, dramatic sound but the home version is very fast, very smooth and entirely compulsive.

The game starts with a screen containing numerous mushrooms. A centipede, which starts at the top, drops to a lower level each time it hits a mushroom, eventually destroying your bug blaster when it reaches it. The aim is therefore to kill the centipede, segment by segment.

The aim is to score as many points as possible, with the computer keeping a record of the highest score. It can be played as a two-player game, with the computer recording both players' scores and playfields — that is, the mushroom patterns — separately.

Each time you destroy a whole centipede, the colours change and a new one starts on its way. Each time you score 10,000 points you get an extra bug blaster and a pretty tune.

Centipede comes with a small eight-page colour instruction booklet. It is an easy game to learn, but very addictive to play.

Specification

Type: Arcade game; real time with colour graphics and sound
Format: ROM cartridge CXL 4020
Launguage: 6502 assembler
System: Atari 400 or 800 plus one or two joysticks
Minimum RAM: Not applicable
Manufacturer: Atari
Price: £29.95
Rating: 17/20

Airstrike

PRODUCED in the U.K. by a small company, Airstrike is just about good enough to sell in the U.S. against the products of Thorn EMI and Atari.

Like the other games reviewed here, Airstrike is a home version of an arcade game — in this case it is a pretty accurate copy of Scramble. To play, you steer a plane through a series of caverns and mazes while dodging or destroying missiles, bombs and — later — enemy fighters launched at you.

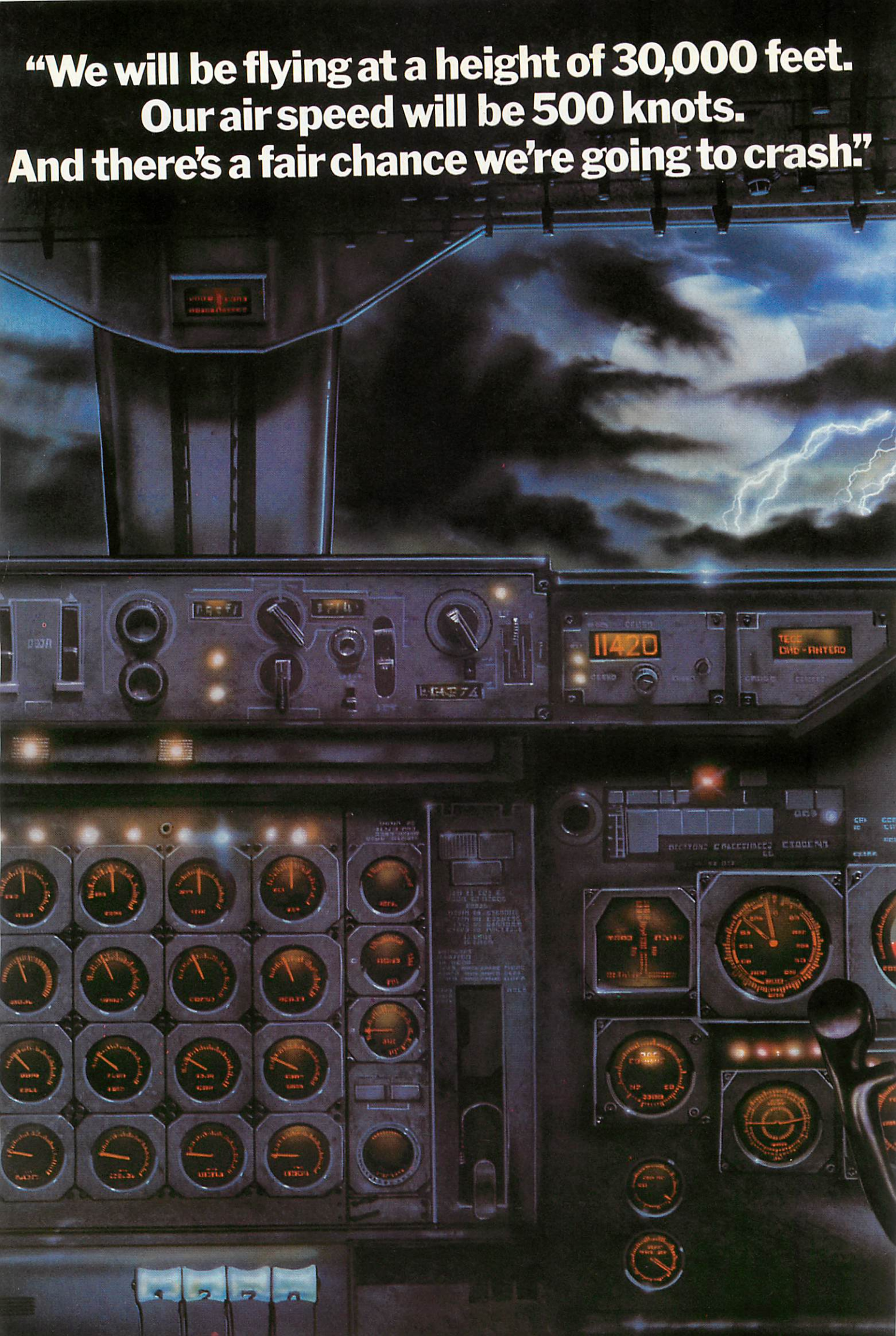
The main problem with the game is that it is too difficult to play. Unlike the arcade version of Scramble, the screen is tiny, which means the action is hair-trigger. Beginners lose the three fighters allowed very quickly, and mastering the game becomes repetitive. Really you need an extra hand or person to operate the bomb release — the space bar — because just handling the joystick and fire button is as much as most people can manage alone.

For real experts, the game can be started at the higher skill levels. It can also be played as a two-player game with the computer holding separate scores as well as the highest score.

There is no instruction book and the instructions given on the card with the cassette are barely adequate. Though not bad value, Airstrike does not quite measure up to the best of the Atari/APX and American opposition — but you will like it if you like Scramble.

Specification

Type: Arcade game
Format: Tape cassette
Language: 6502 assembler
System: Atari 400 or 800 with one or two joysticks
Minimum RAM: Not stated but 16K for tape
Manufacturer: English Software, 50 Newton Street, Piccadilly, Manchester
Price: £19.95, cassette or disc
Rating: 12/20


"We will be flying at a height of 30,000 feet.
Our air speed will be 500 knots.
And there's a fair chance we're going to crash."
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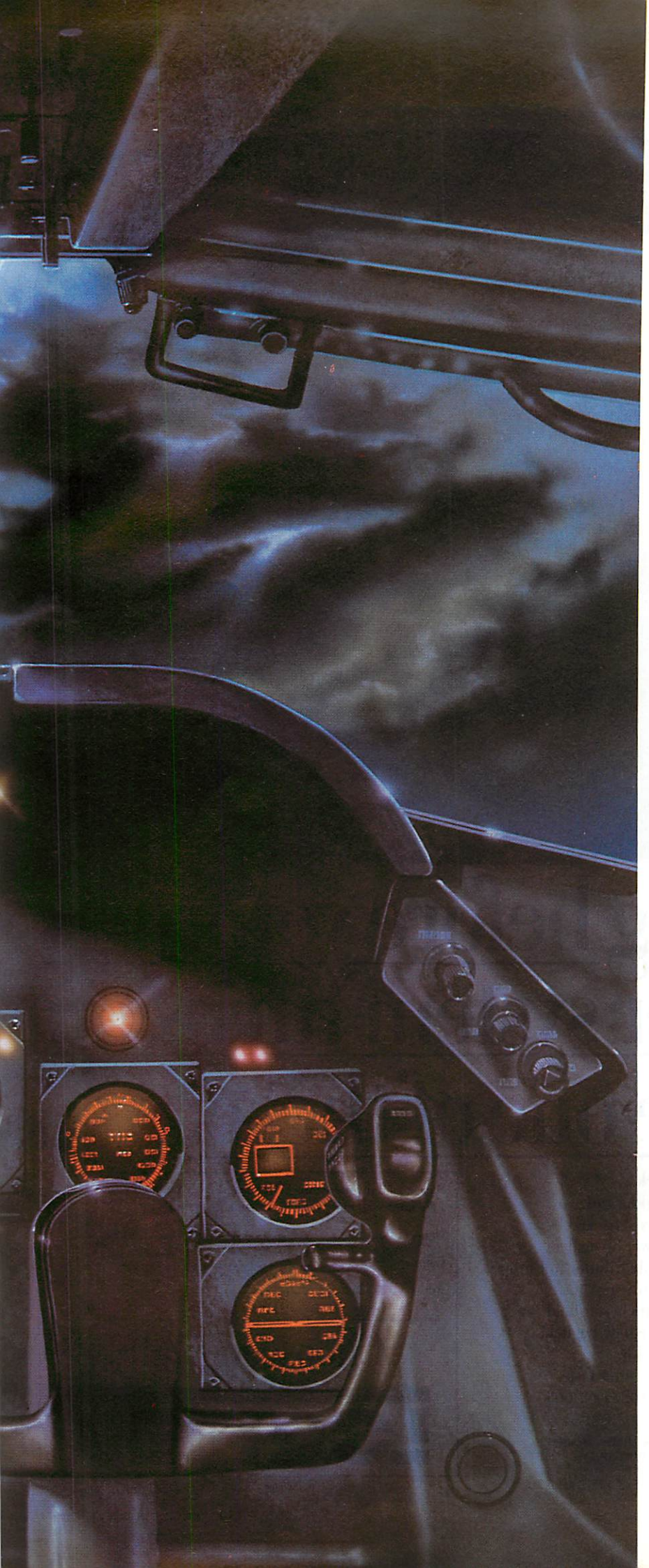
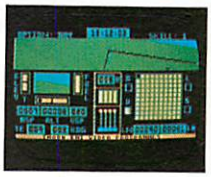


No smoking. Fasten your seat belt. You're about to take off in a 747. But on this flight you're the pilot.

You could hardly describe THORN EMI's 'Jumbo Jet Pilot' as simply another video game. It's more like a session in a flight simulator with life-like instrumentation and graphics.



Jumbo Jet Pilot. 16 K ROM Cartridge. 5 skill levels. Performance rating. Controls: Throttle. Ailerons. Elevators. Undercarriage. Brakes. Stall Indicator. Lights. Fuel. Longitude. Latitude. Air Speed. Artificial Horizon. Altitude. Pitch and Roll. Heading. Vertical Speed. Map Reference and Grid. Time Elapsed.

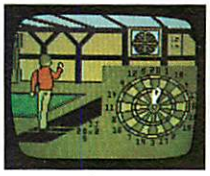
To cope you need to be alert. You should expect the unexpected. And you definitely shouldn't lower the undercarriage when your air speed is dropping and the horizon suddenly appears vertical!

On landing, your in-flight computer will assess your skills and give a 'performance rating'. If you manage to land that is.

'Jumbo Jet Pilot' is one of 21 challenging new home computer games from THORN EMI. It's pretty demanding. But our programs aren't all work and no play.

'River Rescue', 'Kickback', and 'Soccer,' are all-action games. 'Pool' and 'Darts' will suit armchair sportsmen.

And whilst budding Beethovens play the 'VIC Music Composer,' would-be Chancellors can work on their budgets with 'Home Financial Management'.



Darts.

Humpty Dumpty.

We also have educational puzzles for children that will puzzle adults at higher skill levels. But there's one simple idea behind all our titles; we've designed them for players who are bored with run-of-the-mill TV games.

Now, is that Heathrow ahead? Or is it Hyde Park?

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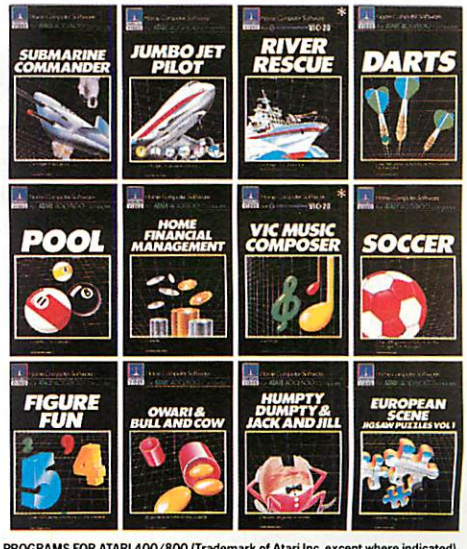

PROGRAMS FOR ATARI 400/800 (Trademark of Atari Inc. except where indicated).
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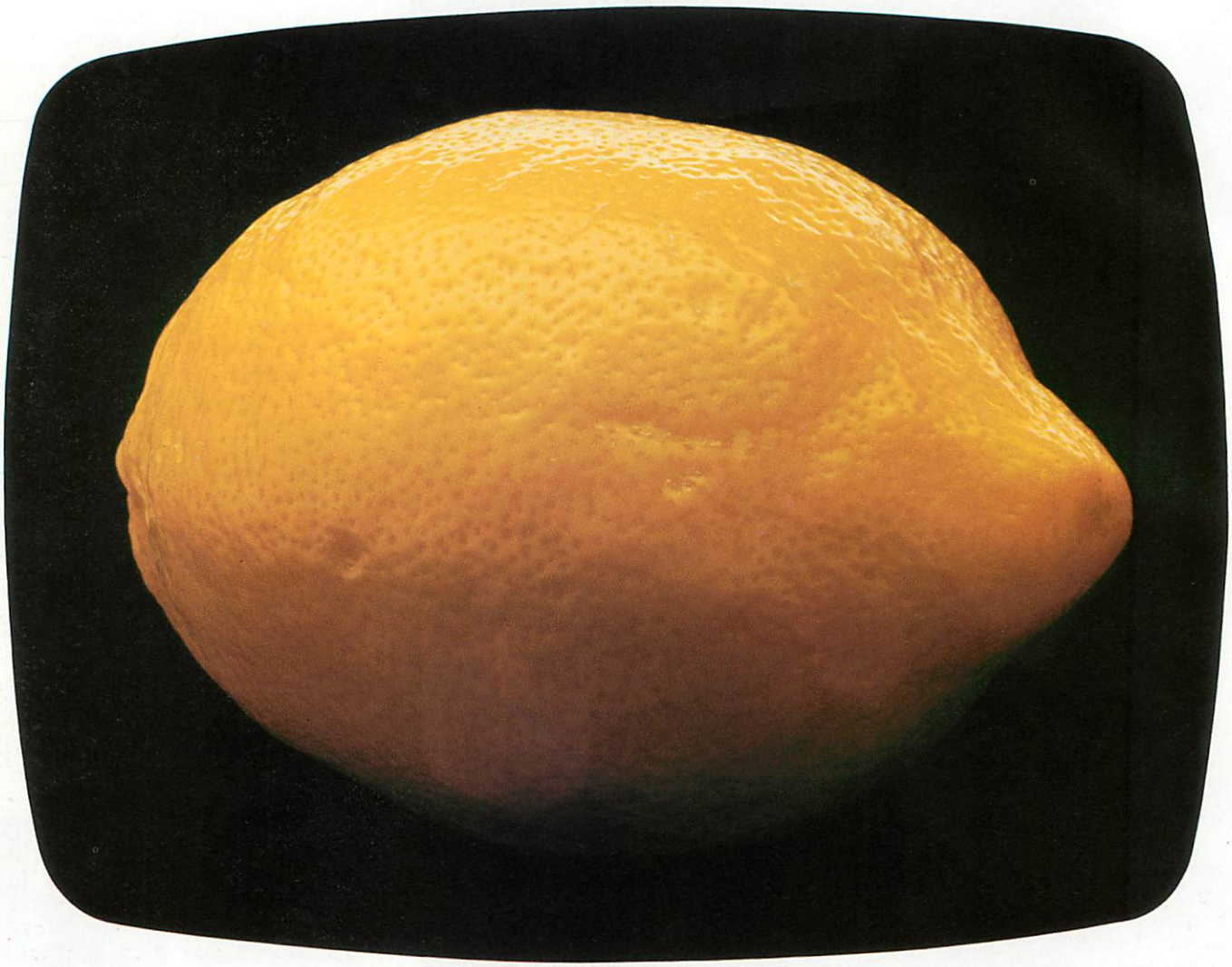

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Revolution in education

Gone are the days of blackboards and textbooks if Richard Ennals' ideas catch on.

IF HISTORY is to be brought alive for students in the classroom they must be actively involved in school trips, research projects, class discussion or historical simulations. Some published simulations lack fine detail and adaptability, and do not allow students the scope to make decisions influencing the subsequent progress of the simulation.

The first attempts to develop a simulation capable of bridging the information gap used Basic for a simulation. It was tested in class, and was followed by a simulation of the Russian Revolution. Yet both models suffered from a number of crucial limitations.

The data description on individual characters was limited, not reflecting the richness of detail required. The process of interrogating and updating the database was relatively elaborate and preset, and only a finite range of queries and updatings was available. The database operated independently of the chronological program and the impact of decisions on the subsequent chronological program and state of the database was too crude and limited.

Prolog was then substituted for Basic and used to handle the same historical simulations working from identical source materials and accompanied by the same printed documentation. MicroProlog, a microcomputer implementation of Prolog for the Z-80 chip and the CP/M operating system, is available through Logic Programming Associates, 36 Gorst Road, London SW11 6JE. In these Prolog simulations the computer is used to facilitate decision and judgement on the part of the students thereby extending their capacity to consider information and see the effect of their decisions and actions on the network of which they form a part.

The briefing for individual characters in the Russian Revolution game was written before the development of computer-assisted versions of the simulation materials. The model for constructing such briefings is a network of relationships: a representation of the positions, wants, tactics and problems of 30 historical characters is presented using a common vocabulary for ease of developing and contrasting the information given. Participants should be able to function initially using the information given but be equipped with the language, constructs or notation with which to expand or change over the course of the simulation.

The form of the briefing information, issued on 30 separate briefing sheets, arises from the construction of complex semantic networks at the design stage used as a means of controlling the considerable volume of data. Translating such materials

into the form of a Prolog database is straightforward.

The Prolog database has immediate advantages for the participants. They are able to ask questions whose answers help them reach decisions. The questions are asked in Prolog and use the same formalism as the database. Participants can amend the database themselves by deleting or adding sentences.

The database is constructed in a simple notation whose interpretation in English is explicit. Economy of programming style is sacrificed in the cause of participation. For example, the program might contain the following information about the peasant:

```
Peasant wants bread
Peasant wants peace
Peasant wants land
English: Who wants better government?
Proglog: Which ((x) x wants better-
  government)
  Answer is (Soldier)
  Answer is (Sailor)
  Answer is (Peasant)
  Answer is (Factwker)
  No (more) answers
English: Who has tactics of non-
  cooperation?
Prolog: Which ((x) x tactics non-
  cooperation)
  Answer is (Lenin)
  Answer is (Tsar)
  Answer is (Tsarina)
  No (more) answers
English: Does Lenin support the Tsar?
Prolog: Does (Lenin supports Tsar)
No
To add new information regarding the
peasant you have to add:
  Add (Peasant supports Tsar)
```

The revised database can be saved at any stage of the simulation, provided other component programs are not loaded at the same time. Saving under a series of different names is recommended to avoid loss of information.

In a conventional simulation it is important to establish the historical context of the simulation in order to reduce the level of anachronism and misconception. Often an introduction is provided in the form of an opening lesson, a talk, film or printed materials. This will offer a framework upon which the simulation is to be constructed.

The Russian Revolution simulation is accompanied by printed introductory materials describing the state of Russia at the turn of the 20th century, Russian involvement in the First World War and contemporary social and political tensions. Altogether they provide a context for the events of 1917 which are to be reconstructed by the participants in the classroom.

Translating these three introductory pieces into Prolog programs is not difficult. A few names and details are discarded but the framework is faithfully recorded. Students can still have the original printed versions but the Prolog programs can directly affect the other components of the Russian Revolution package written in the same notation and with a common vocabulary. For example, historical background information is represented by

```
(Imperial-Russia mobilises army) date 1914
```

Then you can find out information about the different political parties:

(continued on next page)

(continued from previous page)

English: What did the Bolsheviks want?
Prolog: Which ((x) Bolsheviks want x)
Answer is (abolish-property)
Answer is (income-tax)
Answer is (nationalise-industry)
Answer is (free-education)
Answer is (world-revolution)
Answer is (remove-bourgeoisie)
Answer is (dictatorship-of-proletariat)
No (more) answers

No amendment of these programs is necessary. They are designed to apply constraints from the real world to the closed world of simulation, in a way that can visibly affect the logic of decision. In teaching history it is important to enable students to understand the reasons for the actions of historical agents. One way is to construct a practical inference, and Prolog simulation programs hold considerable promise for modelling and reconstructing events.

It is crucial to the success of any historical simulation that events and decisions can be located in a chronological context. To avoid needless anachronism it should be established what known historical events have preceded the situation under reconstruction. Similarly, during the simulation it is important to know what holds true at any given time as participants should be able to record their decisions and actions to form part of the framework for later decisions. It is remarkably easy to do this in Prolog.

Presented with the notation in Prolog students are able to record their own decisions and add their own information to the program. The notation conforms visually to English syntax though technically there are numerous differences. For instance, using the built-in relation Less, time-handling definitions can be built up as follows:

x lesseq x
x lesseq y if x LESS y
x during (y z) if y lesseq x and x lesseq z
x at y if x for (z X) and y during (z X)
(Bolsheviks oppose war) for (1 12)

If you are now at round 5 in this simulation and want to know what is known to hold true ask:

Which ((x) x at 5)
Answer is ((Bolsheviks oppose war))
No (more) answers

You might want to record a decision of a particpant at this stage:

Add ((Tsar orders tea) at 5)

It is then added to what is known to hold true so that if you ask the questions again there is a new answer:

Which ((x) x at 5)
Answer is ((Bolsheviks oppose war))
Answer is ((Tsar orders tea))
No (more) answers

The Prolog notation is easily adapted to take on the role of a simple expert system in directing such a simulation. At any given stage or round in the simulation the program can refer participants to primary or secondary historical sources. It can also emphasise particular issues, retrieve pieces of information, issue instructions or perhaps set problems to participants.

The program itself can be amended by the teacher to take account of the needs of his or her students. For instance, if you have reached round 7 you can type in:

Add (game round 7)

To find out what the key issue is thought to be, ask:

Which ((x) issue is x)
Answer is (reforms)
No (more) answers

To find out which of the printed documents to refer to at this stage ask:

Which ((x) see source x)
Answer is (24 25 26)
No (more) answers

As a refinement to this program you could add the idea that anything the Tsar orders at any time is an issue thereafter:

Add (issue is x if (Tsar orders x) at y and game round z and y lesseq z)

To see the effect of this addition ask:

Which ((x) issue is x)
Answer is (reforms)
Answer is (tea)
No (more) answers

MicroProlog will be ready early in 1983 for the Sinclair Spectrum and BBC Micro, and courses in using the language are being organised by the MEP. The book *Beginning MicroProlog* by the author of this article is published by Ellis Horwood Ltd and Heinemann Computers in Education Ltd at £6.50 in paperback and £12.50 in hardback. It includes recent developments of principles outlined in this article.

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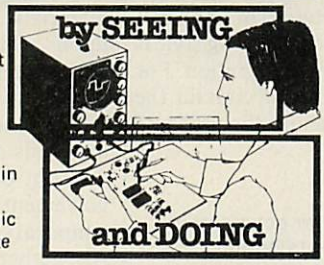

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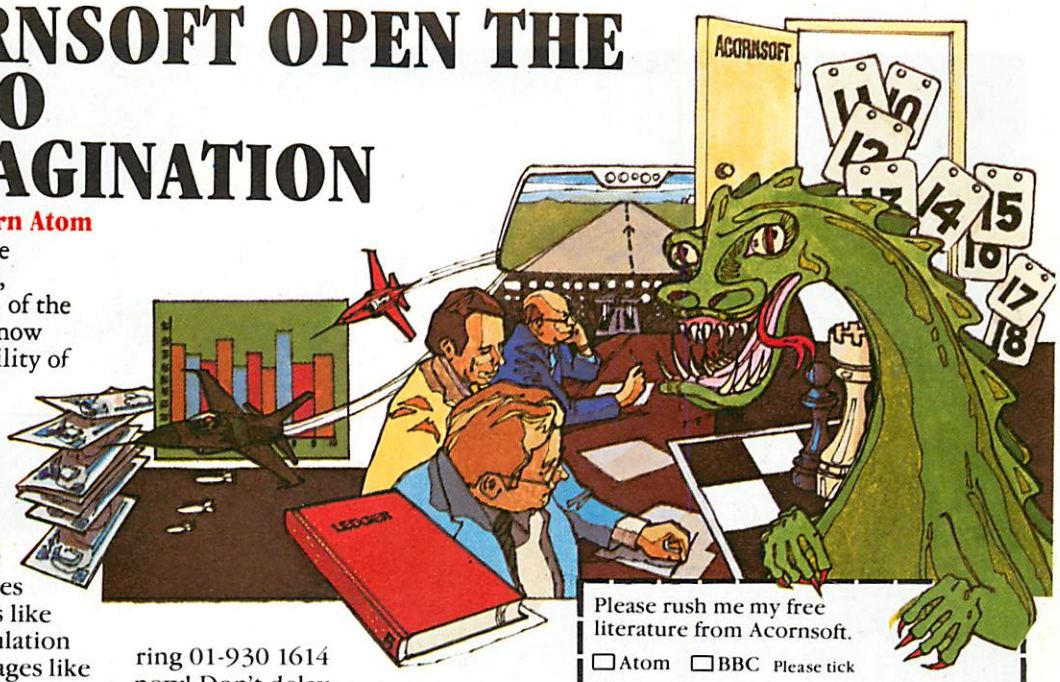

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"Numerous, nevertheless, are the moralists who have attacked the machine as the source of all the ills we bear, who, creating a fictitious dichotomy, have denounced the mechanical civilization as the enemy of the spiritual civilization. Have they ever really asked themselves this question? The central struggle of men has ever been to understand one another, to join together for the common weal. And it is this very thing that the machine helps them to do! It begins by annihilating time and space."

"The Tool", in *Wind, Sand and Stars* by Antoine de Saint-Exupéry (1939)

"One might imagine that out of self-interest, every manufacturer and every businessman would rush to buy a computer or a computer control system as soon as it became available to him. Of course some do, but many do not."

The Reith Lectures for 1964 by Sir Leon Bagrit, published as *The Age of Automation.*

IT — ideology and reality

by Boris Allan

DESPITE many protestations to the contrary, the IT 82 campaign seems to have had little influence on the ordinary person. Perhaps its greatest impact was made on September 8, 1982, the day when people from all walks of life put themselves out for IT 82 — the day upon which the commemorative postage stamps were issued. Who knows, in years to come these stamps might be the year's most famous result.

IT 82 is a year to encourage information technology, itself a remarkably diffuse concept. There is information technology, the reality: the computers, VTRs, Ceefax, Com, word processors, and all the other handy gadgets and systems. There is information technology, the concept: the idea that all these items have something in common that places them together. Finally there is IT, the ideology: the religion of information technology, an ideology which presupposes that salvation will only come when we accept the gospel of IT.

The difference between the three faces of IT can be seen in the type of questions one asks to find out what someone knows of the field: Do you know what is a computer, a VTR, a word processor, Prestel, etc? Do you know what Information Technology is? Do you know what this symbol — the IT 82 logo — means?

The importance of distinguishing between them is revealed when you examine some of the IT 82 advertisements. Consider the one with the banner above a photograph of a boy using a BBC Micro: "Is he better equipped to run an office than you are?" Here is a boy who knows about one aspect of information technology. Why should he be able to run an office, something which has more to do with human relations? And why is it a boy anyway? Plenty of women run offices. Does this boy know what information technology is or does he think that IT is the third person neuter pronoun?

There is a strong tendency to indulge in hyperbole. In the same advertisement you can read that a key advantage of computers is their ability to store vast quantities of information, "infinitely" more than you can hold in your head or cope with on paper. Frederick P Brooks, an IBM employee and author of *The mythical Man-Month: Essays on Software Engineering,* does not share the salesman-projected vision of the management total information system. He writes: "One reason is that only a small part — perhaps 20 percent — of the executive's time is spent on tasks where he needs information from outside his head. The rest is communication: hearing, reporting, teaching, exhorting, counselling, encouraging. But for the fraction that is data-based, the handful of critical documents are vital, and they will meet almost all needs."

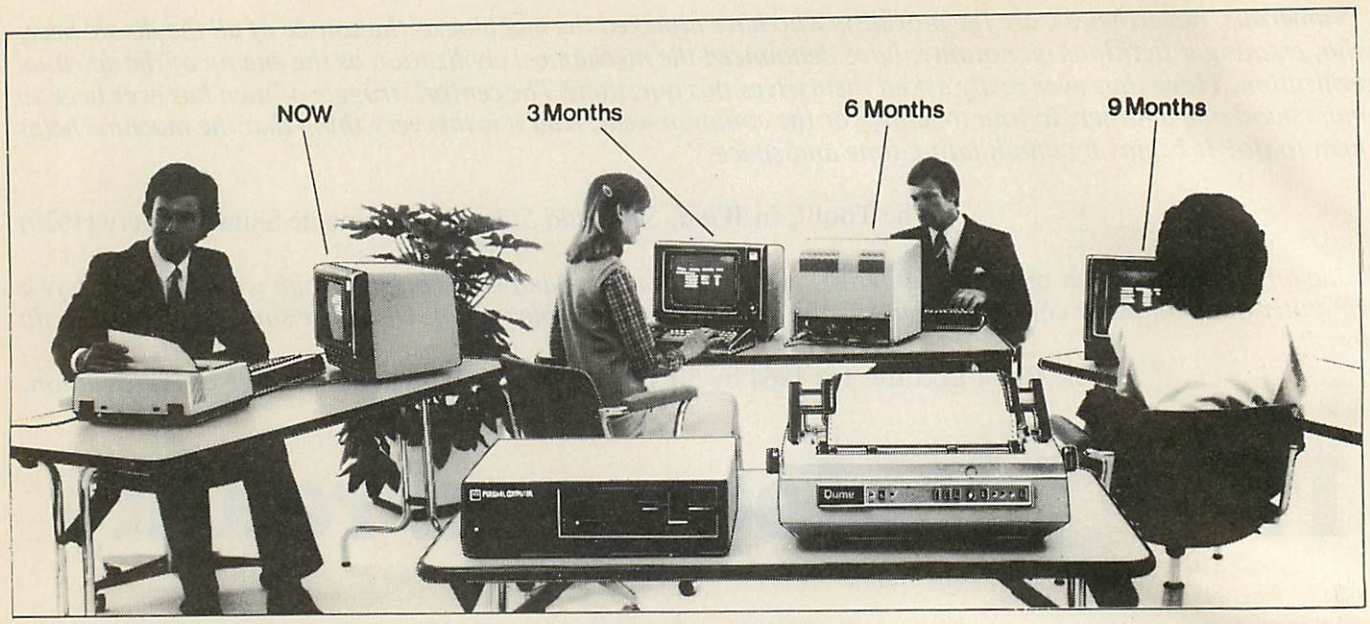
Barclays Bank assisted with another of the IT 82 advertisements, the one which proclaimed "Open 24 hours a day, seven days a week" over a picture of the pair eagerly getting their money from a cash dispenser late at night. This advertisement makes interesting reading, for it says "Most of us are paid with the help of IT to keep track of our salaries." Since most of the British population is still paid in cash, I wonder who is "us"?

If you go through the advertisements for IT 82 it becomes rather clear that they are orientated towards an "us" who are male professionals or managers, and that IT is used as a coverall term for anything which can be laid at the door of some form of information technology. Most of us are not paid with the help of IT, as claimed, but rather despite some computerised system, or so it seems at times. A content analysis of the advertisements shows that males (adult) are those who are obviously in command. Females (adult) are a lower species, so it is a woman who is seen at home watching television, the woman who is the receptionist and the woman who is the typist. The males (young) are assertive: "If you think Form IV is tough ... ", or operating an industrial machine. There are no young females.

This orientation seems to be deliberate, and is continued in the series of pamphlets produced by the National Computing Centre for IT 82. The cover of the Health Care pamphlet again shows a male doctor instructing a female nurse, and the content lists ways in which technology has assisted in medicine, ending with the lines "Patients are being helped by shorter waiting times in hospitals, by new treatments, and by better care." Unfortunately this is not what is actually happening, thanks to inadequate government funding and the Health Service dispute. You continually have to remember the reality of the situation: hospitals employ people as do banks, businesses and most other institutions.

Alan Benjamin, the Chairman of IT 82's steering committee, wrote of IT 82 in *Technology Week* June 5, 1982 that "this revolution is all about simplifying society. Or at least helping the management process." The ideological basis of IT is made perfectly clear, emphasising the importance of distinguishing between the reality of information technology — much of which is of great benefit — and the ideology which is trying to ride on the back of the technical successes. We are informed that IT is all about "communication", and Alan Benjamin is Director of Corporate Communication at the CAP Group. Sainte-Exupéry also saw communication and understanding as the justification for "the tool" in his case the aeroplane — but he also gave the human a say in his or her destiny.

In the past, Utopian theorists used to populate their ideal societies with perfect human beings. They believe that people are less than rational if they do not jump on the bandwagon. Utopian thinkers of IT are concerned with non-people and with people substitutes.



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And because ICL is Europe's leading computer company, with thousands of satisfied users in over 80 countries worldwide, **we can offer ICL Trader Point service and maintenance back-up that's second to none.**

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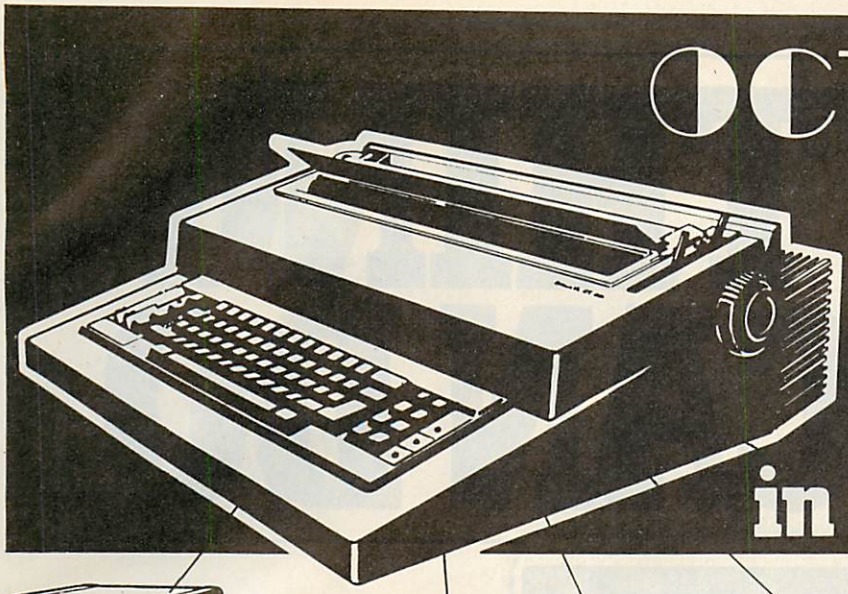
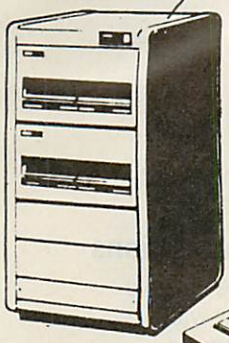
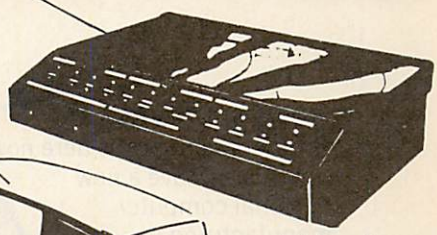




General purpose/Word Processing Computer

OCTET 121



Telex tape preparation

Microcomputer

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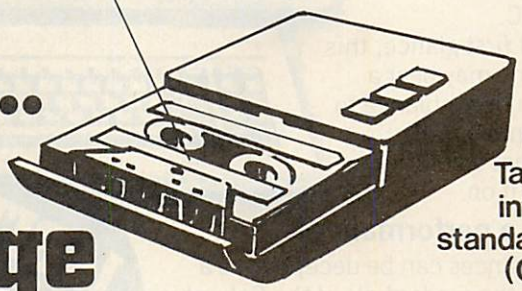

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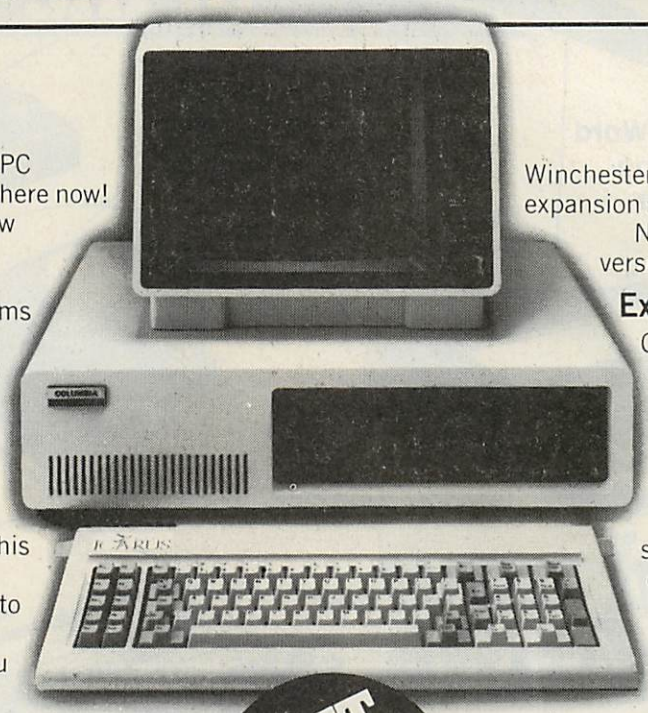

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Icarus have a new personal computer manufactured by Columbia Data Systems of the USA complete with its own software and hardware. It will also run all software and hardware produced for the IBM PC.

At first glance, this machine may bear a certain resemblance to its mentor.

That's before you switch it on.

What a performance!

Appearances can be deceptive as a look at the credentials of the Columbia PC machine will tell you.

Operating system software is MS-DOS® or CP/M 86®.

Its 16 BIT 8088 hardware configuration provides 128 K RAM with parity, two RS-232 serial ports, Centronics parallel printer port, DMA controller, eight levels of interrupt, dual floppy disc system with one megabyte storage, Winchester interface and eight expansion slots.

Not bad for the standard version.

Examine your options

Columbia like to leave your options wide open. So they've included 256K RAM boards, 8087 arithmetic co-processor for high speed math functions, dual RS-232/RS-422 boards, and a Winchester disc based system.

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16 BIT IBM PC COMPATIBLE

It's here now

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For further details, or if you would like to become a dealer yourself, contact

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Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Z-80 Zodiac: Research Machines shuffle routine; Biorhythm calculator on MZ-80K, Assessing text readability; Floating-point numbers on MZ-80K **149**

Tandy Forum: Perpetual calendar on Tandy model III; Graphics characters direct from keyboard **156**

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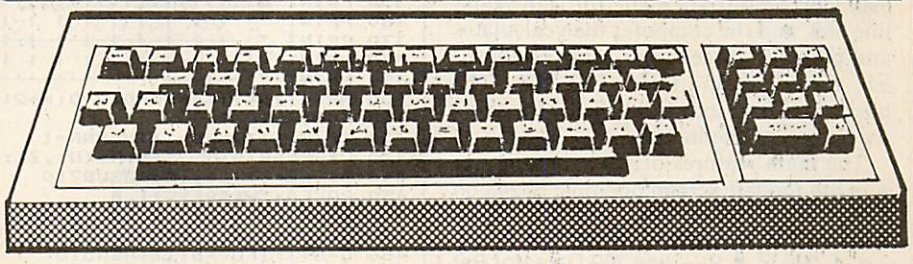
BBC Bytes: Low-speed Teletype interface; Letter Writer mini word processor; Machine-code disassembler **167**

Sinclair Line-up. Fast Fourier transform on ZX-81; Pilot interpreter on ZX-81 **171**

Apple Pie: Morse code teacher; Recovering Newed programs; Apple tree — a programming curiosity; Two utilities — computed Gosubs and Immediate commands; Ampersand command-handling routine **174**

Pet Corner: Pet as a cash register; Perpetual calendar; Loading machine code with Basic; Pools dividend calculator **180**



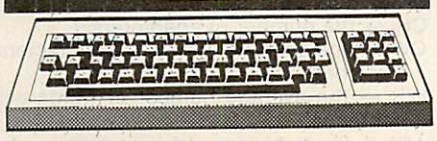
Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

Z-80 ZODIAC



Shuffling routine

WHETHER OR NOT a program like Costello's Eights on page 77 of the August issue of *Practical Computing*, which can play well a game requiring skill,

(continued on next page)

Shuffling routine.

```
100 input"Size of Array";N
110 dimA(N)
120 rem                    FILL ARRAY
130 forI=1toN
140  A(I)=I
150 nextI
160 randomize
165 rem                  SHUFFLE ARRAY
170 forI=1toN
180  X=int(rnd(1)*I)+1
190  D=A(I):A(I)=A(X):A(X)=D
200 nextI
205 rem                  PRINT ARRAY
210 forI=1toN
220  printA(I);
230 nextI
240 print
```

(continued from previous page)
can be said to be displaying intelligence is rather a matter of definition, suggests Tim Scratcherd of Huddersfield, West Yorkshire. However he has an alternative to Costello's shuffling routine. It was suggested by a pupil and requires only one array.

It is written for the Research Machines 380-Z in Software Production Associates structured Basic, and works by swapping every element in an ordered array with an earlier element chosen at random. It is entirely general.

Biorhythm

THREE BIOLOGICAL CYCLES which are held to affect a person's physical, emotional and intellectual energy levels are plotted by the Sharp MZ-80K program by Frank Rooney of Manchester. The user is requested to input his or her date of birth and the date from which the biorhythm is to be run. The computer then calculates the number of days old that the person will be on the starting date, value F in line 690. Corrections are made for leap years, line 680, and the computer then calculates and plots the three cycles using established formulae in lines 540-560. The horizontal base axis is labelled with alternate dates of the month.

The main features of the program are:

A is the top-left screen position: 53248 on MZ-80K, 32768 on Pet

X (I) contains Poke codes for Space, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 — line 760 Data; for Pet use codes 32, 48, 49, 50, 51, 53, 54, 55, 56, 57

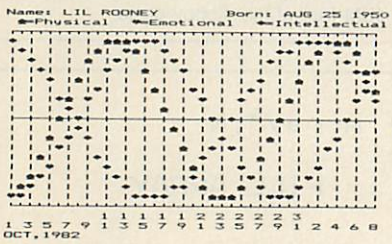
In line 540, B = 65 gives Spade symbol

In line 550, B = 83 gives Heart symbol

In line 560, B = 68 gives Diamond symbol; use 90 on Pet

Inverse-C gives Clear Screen

Biorhythm.




```
Biorhythm.
 10 REM * MZ-80K BIORHYTHM - F.R.Rooney 1982 *
 20 PRINT"■          ♥   B I O R H Y T H M   ♥"
 30 PRINTTAB(11);"■■■■■■■■■■■■■■■■■■"
 40 DIMX(11),M$(12),D(12):X$=" 0123456789":A=53248
 50 FORI=1TO11:READX(I):NEXTI:FORI=1TO12:READM$(I),D(I):NEXTI
 60 PRINT"■Please enter your date of birth -":E$="1945"
 70 GOSUB80:GOTO160
 80 PRINT"■      YEAR  (e.g. ";E$;:INPUT") :";Y
 90 IFY<1901THENPRINT"■■■":GOTO80
100 INPUT"■      MONTH (e.g. 5)     :";M
110 IF(M<1)+(M>12)THENPRINT"■■■":GOTO100
120 INPUT"■      DAY   (e.g. 14)    :";D
130 IF(D<1)+(D>31)THENPRINT"■■■":GOTO120
140 GOSUB600:IFE=0THEN60
150 RETURN
160 GOSUB640:G=F:Y1=Y:M1=M:D1=D
170 INPUT"■Your name : ";N$:IFLEN(N$)<17THEN210
180 USR(62):PRINT"■TOO LONG ! (max 16 letters)                "
190 FORZ=1TO1000:NEXTZ
200 PRINT"■";SPC(27);"■■":GOTO170
210 PRINT"■Enter the date you wish to start from -"
220 E$="1982":GOSUB80
230 PRINT"■■The computer will plot your biorhythm"
240 PRINT"and it will remain on the screen until"
250 PRINT"any key is pressed.■":FORZ=1TO3000:NEXTZ:GOSUB640:H=F
260 IF(M<3)*(Y/4=INT(Y/4))*(Y1/4<>INT(Y1/4))THENG=G+1
270 IF(M>2)*(Y/4=INT(Y/4))*(Y1/4=INT)Y1/4))THENG=G-1
280 IF(Y/4<>INT(Y/4))*(Y1/4=INT(Y1/4))THENG=G-1
290 N=G-H:IFN>0THENGOSUB630:GOTO60
300 P=23*(N/23-INT(N/23)):Q=28*(N/28-INT(N/28))
310 R=33*(N/33-INT(N/33))
320 L=32-LEN(M$(M1)+STR$(D1)+STR$(Y1))
330 PRINT"■Name: ";N$;TAB(L);"Born: ";M$(M1);D1;Y1
340 PRINT"■ ♠=Physical   ♥=Emotional   ♦=Intellectual"
350 PRINT"■┌──────────────────────────────────┐":FORI=0TO7
360 PRINT "│ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │":NEXTI
370 PRINT "├─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┤":FORI=0TO7
380 PRINT "│ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │":NEXTI
390 PRINT "└──────────────────────────────────┘"
400 NR=-1:S=Y:T=M:U=D:V=0:W=21
410 FORI=0TO38
420 IF(U=1)*(NR=-1)THENNR=I
430 C$=RIGHT$("  "+STR$(U),2):IFI/2<>INT(I/2)THEN480
440 B$=LEFT$(C$,1):GOSUB710
450 POKEA+(W*40)+V+I,B
460 B$=RIGHT$(C$,1):GOSUB710
470 POKEA+((W+1)*40)+V+I,B
480 U=U+1:IFU<=D(T)THEN510
490 IF(T=2)*(S/4=INT(S/4))*(U=29)THEN510
500 U=1:T=T+1:IFT>12THENT=1:S=S+1
510 NEXTI:IFNR>30THENNR=30
520 PRINT"■■";M$(M);",";STR$(Y)
530 FORI=0TO38
540 K=INT(8*SIN((-P+I)*2*π/23)+.5):B=65:GOSUB750
550 K=INT(8*SIN((-Q+I)*2*π/28)+.5):B=83:GOSUB750
560 K=INT(8*SIN((-R+I)*2*π/33)+.5):B=68:GOSUB750
570 NEXTI
580 GETA$:IFA$=""THEN580
590 PRINT"■■":GOTO60
600 E=1:IF(D<=D(M))THENRETURN
610 IFM<>2THEN630
620 IF(Y/4=INT(Y/4))*(D=29)THENRETURN
630 E=0:USR(62):PRINT"■INCORRECT DATA":RETURN
640 F=0:IFM<2THEN690
650 FORI=1TOM-1
660 F=F+D(I)
670 NEXTI
680 IFY/4=INT(Y/4)THENF=F+1
690 F=F+365*Y+INT(Y/4)+D
700 RETURN
710 C=1
720 IFB$=MID$(X$,C,1)THENB=X(C):RETURN
730 C=C+1:IFC>11THENB=0:RETURN
740 GOTO720
750 POKEA+(11-K)*40+I,B:RETURN
760 DATA0,32,33,34,35,36,37,38,39,40,41
770 DATAJAN,31,FEB,28,MAR,31,APR,30,MAY,31,JUN,30
780 DATAJUL,31,AUG,31,SEP,30,OCT,31,NOV,30,DEC,31
```

Readability index

AMERICAN RESEARCH has shown that readability and comprehensibility of a text depends very much on word length and sentence length. This program by Noel Williams of Sheffield, South Yorkshire uses the results of that research to measure the readibility of an input text. The program counts the number of sentences by counting punctuation; the number of words, by counting spaces; and the number of letters. It then calculates the average word length and the average sentence length, and then applies the American formula to these averages to rate the readability of the text. The program aims to be user friendly so gives some sample values for familiar texts.

The program runs on a Research Machines 380Z, and being written in Microsoft Basic it should run on other machines with the minimum of change. Lines 70 and 480 clear the screen. The command means Print. The following variables are used:

FS — the number of sentences

SP — the number of words

CH — the number of characters

CW — the average number of characters per word

WS — the average number of words per sentence

ARI — the final index of readability

Line 520 calculates the index. Input should be in English, and should be of more than three sentences for the results to be meaningful.

(continued on page 152)

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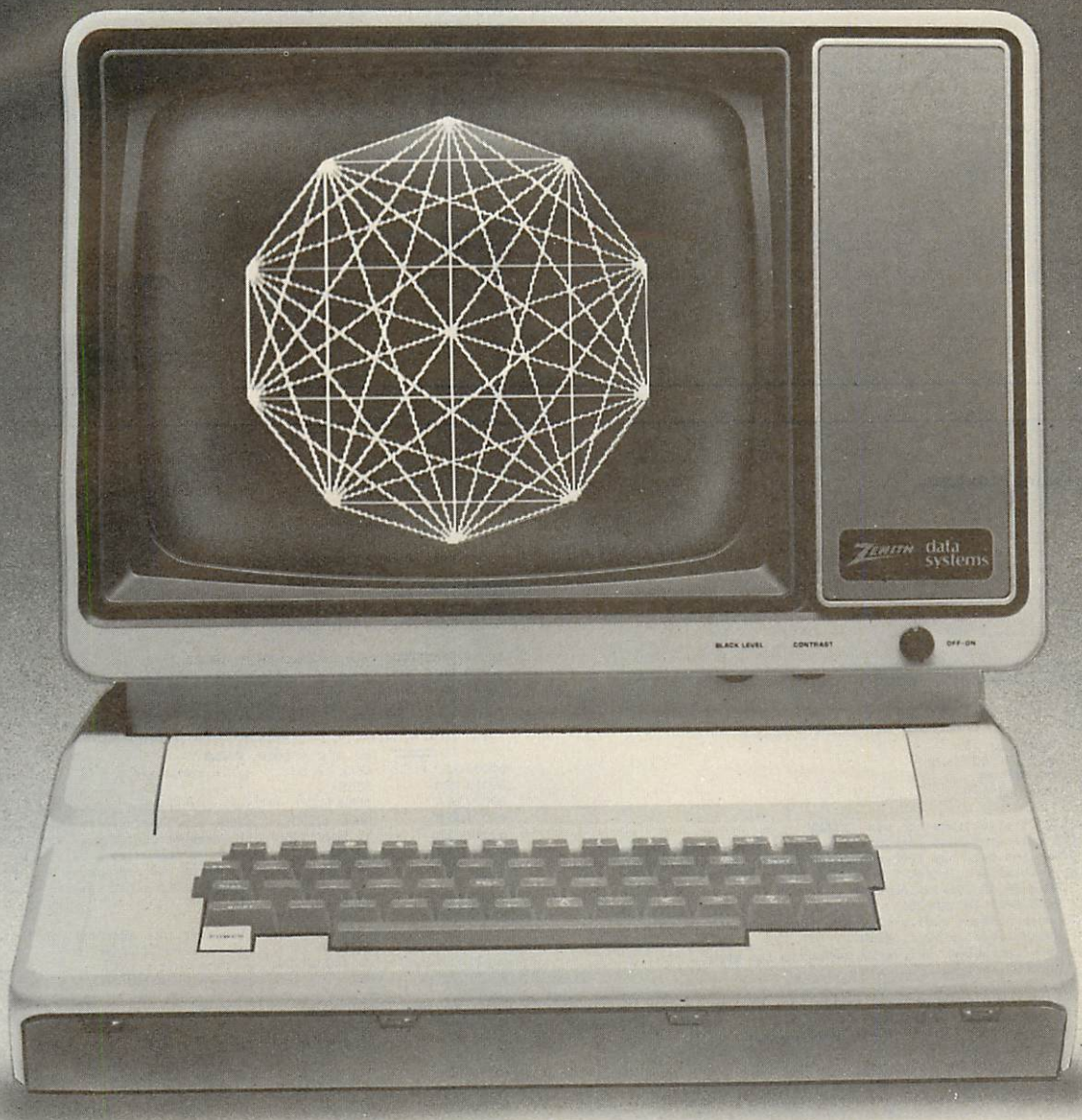

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(continued from page 150)

Readability index.

```
10 REM ****************************
20 REM AUTOMATED READABILITY INDEX
30 REM  "  BY   NOEL WILLIAMS
40 REM SHEFFIELD CITY POLYTECHNIC
50 REM ****************************
60 REM automated readability index
70 PUT12
80 FS=0
90 XZ=0
100 W$="Your text  comes between"
110 WS=0:SP=0:FS=0:CH=0:ARI=0
120 ?" This program examines any input text to see how readable it is."
130 ?:?
140 ?"Please type in a text of more than three sentences."
150 ?:?
160 ?"Make sure there is a full stop after each sentence."
170 ?:?
180 ?"And do not type beyond the '+' "
190 ?"                                          +"
200 ?:?
210 IFXZ=0THEN250
220 ?"Please type in the next line.              +"
230 ?"If there are no more lines please type zzz"
240 ?"                                          +"
250 INPUT A$
260 A$=A$+" "
270 FORI=1 TO LEN(A$)
280 B$=MID$(A$,I,1)
290 IFB$=" "THENSP=SP+1
300 IFB$="."THENFS=FS+1
310 NEXTI
320 CH=CH+LEN(A$)
330 XZ=1
340 REM THIS CALCULATES READABILITY INDEX
350 IFA$="zzz " OR A$="ZZZ "THENGOTO370
360 GOTO220
370 IF FS<3 THEN ?" YOU DIDN'T TYPE ENOUGH SENTENCES.":GOSUB740:GOTO10
380 WS=SP/FS
390 CW=CH/SP
400 ARI=((0.5*WS)+(4.71*CW))-21.43 :REM ari
410 PUT12
420 ?"Your index of readability is ";ARI
430 ?
440 GOSUB740
450 ?"Ah, you don't quite understand this, eh?"
460 ?
470 GOSUB740
480 PUT12
490 ?"Well, the scale is 1 to 40":?
500 ?"So 'Winnie the Pooh' is 6.3":?
510 ?"'Lord of the Rings' is 10.57":?
520 ?"'1984' is 15.28":?
530 ?"Kant's 'Critique of Pure Reason' is 24.05"
540 :?
550 ?"'Ulysses' is 24.25"
560 ?
570 FORI=1TO5
580 READW
590 IFARI)W"THENPS=I
600 NEXTI
610 DATA 6.3,10.57,15.28,24.05,24.25
620 IFPS(1THEN?"Your text is more readable than any of these.":GOTO720
630 ONPSGOTO640,660,680,700,710
640 ?W$;" 'Winnie the Pooh' and  'Lord of the Rings'"
650 GOTO720
660 ?W$;" 'Lord of the Rings' and '1984'"
670 GOTO720
680 ?W$;" '1984' and Kant"
690 GOTO720
700 ?W$;" Kant and 'Ulysses'":GOTO720
710 ?"Your text is even more unreadable than 'Ulysses'":GOTO720
720 REM
730 END
740 FORI=1TO4000:NEXTI
750 RETURN
```

Floating-point numbers.

```
1 REM      ***********************
2 REM      * software stack sub *
3 REM      ***********************
4 REM
5 REM    copyright Simon N. Brown
6 REM
7 REM         28th June 1982
8 REM
9 REM=============================================
999 REM***** example of use *****
1000 GOSUB 50000
1100 POKE SP,0:POKE SP+1,200
1200 A=1:B=99999
1300 PRINT "A=";A,"B=";B
1310 USR(PU),A,B:USR(PO),A,B
1320 PRINT "** SWAP **"
1400 PRINT "A=";A,"B=";B
1500 END
48999 REM***** instructions for use *****
49000 REM The following code supports a software stack and maintains it.
49001 REM After the data has been set up in memory the stack pointer should
49002 REM be initialised.To set the pointer to an address AD :-
49003 REM   POKE SP,AD-256*INT(AD/256)
49004 REM   POKE SP+1,INT(AD/256)
49005 REM To push numbers exp1,exp2..expN onto the stack :-
49006 REM   USR(PU),exp1,exp2...,expN
49007 REM To pop variables var1,var2..varN from the stack :-
49008 REM   USR(PO),var1,var2,..,varN
49009 REM
49010 REM Use of these routines will enable variables to be used locally.
49011 REM For example,if a subroutine uses X,Y,Z for internal calculations
49012 REM then the first line of the subroutine would be :-
49013 REM   USR(PU),X,Y,Z
49014 REM and the last line could be:-
49015 REM   USR(PO),Z,Y,X:RETURN
49016 REM This should relieve the necessity to invent temporary variables
49017 REM with names like ZK,QG,ZS etc through fear of altering other
49018 REM the contents of variables that you may use elsewhere.
49019 REM
49020 REM The routine should also prove useful to other MZ-80K users
49021 REM as it illustrates the use of routines in the BASIC interpreter.
49022 REM
49023 REM N.B. This routine depends on routines within Sharp BASIC SP-5025
49024 REM ---------------------------------------------------------------
49999 REM***** software stack routines to PUSH and POP *****
50000 PU=12*4096:PO=PU+32:SP=4096+256+14:LIMIT PU
50010 FOR J=0 TO 79:READ E:POKE PU+J,E:NEXT
50020 E=PU+27
50030 POKE PU+4,E-256*INT(E/256)
50040 POKE PU+5,INT(E/256)
50050 E=PU+70
50060 POKE PU+36,E-256*INT(E/256)
50070 POKE PU+37,INT(E/256)
50080 RETURN
50099 REM***** machine code DATA *****
50100 DATA 205,136,22,44,0,0,205,235,29,42,14,17,1,5,0,9
50110 DATA 34,14,17,235,42,68,70,237,176,24,229,34,1,72,201,0
50120 DATA 205,136,22,44,0,0,205,19,38,205,54,36,34,1,72,213
50130 DATA 80,205,20,24,209,42,14,17,1,5,0,237,176,1,246,255
50140 DATA 9,34,14,17,24,218,34,1,72,201,0,0,0,0,0,0
59999 REM***** Z80 source code *****
60000 REM PUSH   CALL 168BH      ;skip comma and update text pointer
60010 REM        DEFB ","        ;
60020 REM        DEFW PUEX       ;if none present jump to PUEX
60030 REM        CALL 1DEBH      ;evaluate fp expression to area at (4644H)
60040 REM        LD HL,(110EH)   ;HL=present contents of soft stack pointer
60050 REM        LD BC,5         ;each fp number is 5 bytes long
60060 REM        ADD HL,BC       ;work out new address of top of soft stack
60070 REM        LD (110EH),HL   ;update soft stack pointer
60080 REM        EX DE,HL        ;
60090 REM        LD HL,(4644H)   ;
60100 REM        LDIR            ;transfer fp number onto soft stack
60110 REM        JR PUSH         ;go back for another one
60120 REM PUEX   LD (4801H),HL   ;update text pointer past USR statement
60130 REM        RET             ;return to BASIC
60140 REM ----------------------------------------------------------------
60150 REM POP    CALL 168BH      ;skip comma and update text pointer
60160 REM        DEFB ","        ;
60170 REM        DEFW POEX       ;if none present jump to POEX
60180 REM        CALL 261CH      ;scan variable name aborting if FN..
60190 REM        CALL 2436H      ;DE=addr of var,B=var type(0=fp,1=string)
60200 REM        LD (4801H),HL   ;update text pointer
60210 REM        PUSH DE         ;save address of variable
60220 REM        LD D,B          ;
60230 REM        CALL 1814H      ;test var type,abort if string type
60240 REM        POP DE          ;recover address of variable
60250 REM        LD HL,(110EH)   ;HL=present contents of soft stack pointer
60260 REM        LD BC,5         ;each fp number is 5 bytes long
60270 REM        LDIR            ;transfer fp number from soft stack to var
60280 REM        LD BC,-10       ;
60290 REM        ADD HL,BC       ;work out new address of top of soft stack
60300 REM        LD (110EH),HL   ;update soft stack pointer
60310 REM        JR POP          ;go back for another one
60320 REM POEX   LD (4801H),HL   ;update text pointer past USR statement
60330 REM        RET             ;return to BASIC
```

Floating-point numbers

THIS PROGRAM by Simon Brown of Tunbridge Wells, Kent for the Sharp MZ-80K implements a stack for floating-point numbers in software. It can be used for maintaining local numeric variables. The machine code used is fully documented and so should prove of use to other MZ-80K users in understanding the operation of some routines within the Basic interpreter.

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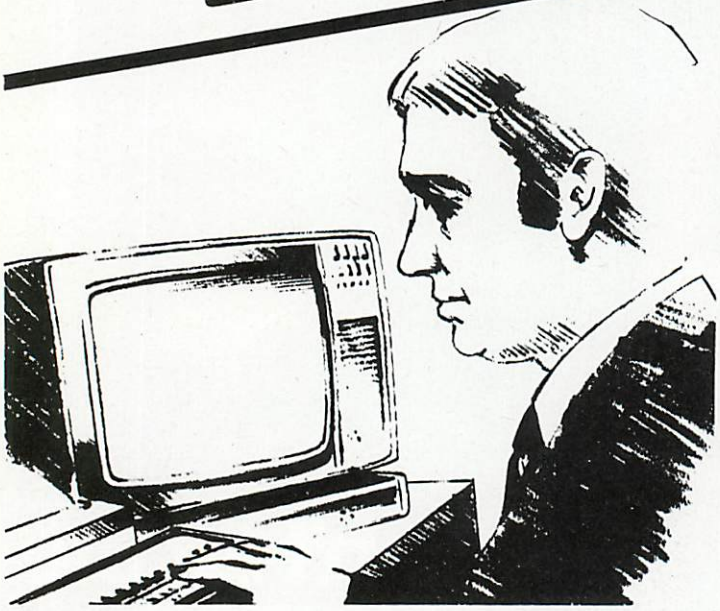

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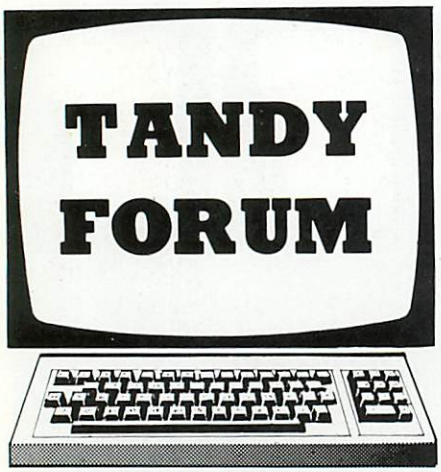

Perpetual calendar

THE PROGRAM written by S J Combes of Bishop's Stortford, Hertfordshire for a Tandy Model III microcomputer asks for the date in digits which it then converts to the format: day, date, month and year in full. For example, 7.12.82 is converted to Tuesday 7th December 1982. Only valid dates can be entered; the program accepts any day since the beginning of 1940.

The program consists of the following sections

Lines 10-80 input date and call subroutines.
Lines 1000-1050 check for valid date.
Lines 2000-2020 find number of days between years.
Lines 3000-3500 check if year in Y2 is a leap year and returnes 1 in Y4 if true; the turn of the century is only a leap year if divisible by 400.
Lines 4000-4020 find number of days between months.
Line 5000 finds number of days.
Lines 6000-6060 calculate rest of date.
Lines 9000-9010 set up variables.
The main variables are:

Y — start year
M — start month
D — start day
YR — present year
DA — present day
MO — present month
A£( ) — months
A( ) — days in months
B£( ) — days in week

(continued on page 158)

Perpetual calendar.

```
10 CLEAR200:DIMA€(12),A(12),B€(7)
20 CLS:PRINT"CALENDAR":PRINT:PRINT:INPUT"DAY ";DA
30 INPUT"MONTH ";MO:INPUT"YEAR ";YR
40 RESTORE:GOSUB9000:GOSUB1000:CLS
50 GOSUB2000:S=Z#
60 GOSUB4000:S=S+X
70 GOSUB5000:S=S:S=S-INT(S/7)*7:IFS=0THENS=7
80 Z€=B€(S):GOTO6000
999 REM *** SUB TO CHECK FOR VALID DATE ***
1000 IFMO=2THENY2=YR:GOSUB3000:GOSUB20000
1005 IFMO<1ORMO>12THEN20ELSEMO=INT(MO)
1010 IFDA>A(MO)ORDA<1THEN20ELSEDA=INT(DA)
1020 IFYR<100THENYR=YR+1900
1030 IFYR<YTHEN20ELSEIFYR=YANDMO<MTHEN20
1040 IFYR=YANDMO=MANDDA<DTHEN20
1050 YR=INT(YR):Y1=YR-1900:RETURN
1999 REM *** SUB TO FIND NUMBER OF DAYS BETWEEN YEARS ***
2000 Z#=0:IFY=YRTHENRETURN
2010 FORA=YTOYR-1:Y2=A:GOSUB3000:IFY4=1THENZ#=Z#+366ELSEZ#=Z#+365
2020 NEXTA:S=S+1:RETURN
2999 REM *** SUB TO FIND IF Y2 IS A LEAP YEAR ***
3000 IFY2/100=INT(Y1/100)THEN3500
3010 Y3=Y2-1900:IFY3/4=INT(Y3/4)THENY4=1ELSEY4=-1:RETURN
3020 RETURN
3500 IFY2/400=INT(Y2/400)THENY4=1:RETURNELSEY4=-1:RETURN
3999 REM *** COUNT DAY INTERVAL IN MONTHS ***
4000 IFM=MOTHENX=0:RETURN
4010 FORA=MTOMO-1:Y2=YR:GOSUB3000:IFY4=1THENA(2)=29ELSEA(2)=28
4020 X=X+A(A):NEXTA:RETURN
4999 REM *** COUNT REMAINING DAYS ***
5000 D9=DA+1-D:S=S+D9:RETURN
5999 REM *** CALCULATE REST OF DATE ***
6000 IFDA=1ORDA=21ORDA=31THENC€="st.":GOTO6040
6010 IFDA=2ORDA=22THENC€="nd.":GOTO6040
6020 IFDA=3ORDA=23THENC€="rd."ELSEC€="th."
6040 M€=A€(MO):Y€=STR€(YR):A€=STR€(DA)+C€+M€+Y€
6050 CLS:A€=Z€+A€:PRINTA€
6060 PRINT:PRINT:END
8999 REM *** SET UP VAIRIABLES ***
9000 FORA=1TO12:READA€(A),A(A):NEXTA:FORA=1TO7:READB€(A):NEXTA
9010 Y=1940:D=1:M=1:RETURN
10000 DATAJanuary,31,February,28,March,31,April,30,May,31,June,30,July,31,Aug
ust,31,September,30,October,31,November,30
10010 DATADecember,31,Monday,Tuesday,Wednesday,Thursday,Friday,Saturday,Sunda
y
19999 REM *** SET DAYS IN FEB. ***
20000 IFY4=1THENA(2)=29:RETURNELSERETURN
```

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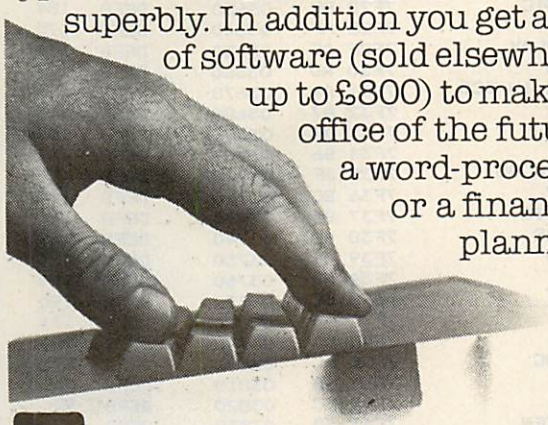

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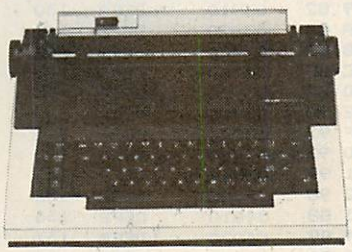

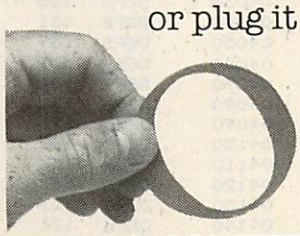

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(continued from page 156)

Keyboard graphics

AN ASSEMBLER listing by Satnam Singh of Walsall, West Midlands allows graphics characters to be accessed directly from the keyboard of a TRS-80 or Video Genie. After loading the routine you have the option of operating the micro in normal mode or Graphics mode.

First enter Command mode and press Shift-down arrow. A "GR" should appear in the top right-hand corner of the screen to indicate that you are in Graphics mode. Hitting any key on the top row will produce a graphics character while Shift and any key on the top row should produce the normal shift characters. Hitting any of the alphabet characters, shifted or unshifted, produces other graphics characters. The top row gives graphics only when unshifted because there are only 64 graphics characters. The alphabet keys produce 26 graphics, unshifted and 26 shifted, leaving only 12 more graphics. Since there are 12 keys on the top row, excluding Break, there is no need to make use of the shifted characters on the top row.

The other keys remain unchanged in Graphics mode so you still have full control of the screen at all times. To exit from Graphics mode press the Break key once. The "GR" in the top right-hand corner of the screen should vanish.

If you attempt to enter Graphics mode after typing List you can list the Basic program line by line by keying Enter. Keying Break causes the listing to continue as normal.

Keyboard graphics.

```
                02840 ; KEYBOARD GRAPHICS
                02850 ; BY SATNAM SINGH
                02860 ;
7E9E DD21A97E   02870 STARTS  LD      IX,STARTY       ;GET STARTY
7EA2 DD221640   02880         LD      (4016H),IX      ;PLUG INTO ROM
7EA6 C3CC06     02890         JP      06CCH           ;JP TO READY
7EA9 3A8038     02900 STARTY  LD      A,(3880H)       ;GET SHIFT KEY
7EAC FE01       02910         CP      1               ;PRESSED ??
7EAE C2E303     02920         JP      NZ,03E3H        ;NO THEN BASIC
7EB1 3A4038     02930         LD      A,(3840H)       ;IF "↓" PRESSED?
7EB4 FE10       02940         CP      16              ;IS IT??
7EB6 C2E303     02950         JP      NZ,03E3H        ;NO THEN BASIC
7EB9 DD214752   02960         LD      IX,5247H        ;IX = 'GR'
7EBD DD223E3C   02970         LD      (3C3EH),IX      ;PUT ON DISPLAY
7EC1 DD21CC7E   02980         LD      IX,GRAFON       ;IX = GRAFON
7EC5 DD221640   02990         LD      (4016H),IX      ;PLUG GRAFON IN DCB
7EC9 C3E303     03000         JP      03E3H           ;JP TO DCB
7ECC CDE303     03010 GRAFON  CALL    03E3H           ;A$=INKEY$
7ECF FE00       03020         CP      0               ;IS A$=""
7ED1 28F9       03030         JR      Z,GRAFON        ;IF A$=""THEN GO
7ED3 FE01       03040         CP      1               ; <BREAK> ??
7ED5 281A       03050         JR      Z,EXIT          ;EXIT IF IT IS
7ED7 FE20       03060         CP      32              ;CONTROL CHAR
7ED9 D8         03070         RET     C               ;BASIC IF SO
7EDA D620       03080         SUB     32              ;A = A - 32
7EDC 4F         03090         LD      C,A             ;C = A
7EDD 0600       03100         LD      B,0             ;ZERO B
7EDF DD21047F   03110         LD      IX,TABLE1       ;IX = TABLE
7EE3 DD09       03120         ADD     IX,BC           ;IX = IX + BC
7EE5 DD7E00     03130         LD      A,(IX+00)       ;GET CHAR
7EE8 DD214752   03140         LD      IX,5247H        ;IX = "GR"
7EEC DD223E3C   03150         LD      (3C3EH),IX      ;PUT ON SCREEN
7EF0 C9         03160         RET                     ;RET WITH CHAR
7EF1 DD21A97E   03170 EXIT    LD      IX,STARTY       ;IX = STARTY
7EF5 DD221640   03180         LD      (4016H),IX      ;PLUG INTO ROM
7EF9 DD212020   03190         LD      IX,2020H        ;IX ="  "
7EFD DD223E3C   03200         LD      (3C3EH),IX      ;REPLACE "GR" WITH "  "
7F01 C3E303     03210         JP      03E3H           ;JP TO DCB
7F04 20         03220 TABLE1  DEFB    32        ;TABLE OF GRAPHICS
7F05 21         03230         DEFB    33
7F06 22         03240         DEFB    34
7F07 23         03250         DEFB    35
7F08 24         03260         DEFB    36
7F09 25         03270         DEFB    37
7F0A 26         03280         DEFB    38
7F0B 27         03290         DEFB    39
7F0C 28         03300         DEFB    40
7F0D 29         03310         DEFB    41
7F0E 2A         03320         DEFB    42
7F0F 2B         03330         DEFB    43
7F10 2C         03340         DEFB    44
7F11 9F         03350         DEFB    159
7F12 2E         03360         DEFB    46
7F13 2F         03370         DEFB    47
7F14 9E         03380         DEFB    158
7F15 A5         03390         DEFB    165
7F16 9A         03400         DEFB    154
7F17 A4         03410         DEFB    164
7F18 9B         03420         DEFB    155
7F19 A3         03430         DEFB    163
7F1A 9C         03440         DEFB    156
7F1B A2         03450         DEFB    162
7F1C 9D         03460         DEFB    157
7F1D A1         03470         DEFB    161
7F1E A0         03480         DEFB    160
7F1F 3B         03490         DEFB    59
7F20 3C         03500         DEFB    60
7F21 3D         03510         DEFB    61
7F22 3E         03520         DEFB    62
7F23 3F         03530         DEFB    63
7F24 40         03540         DEFB    64
7F25 B5         03550         DEFB    181
7F26 A8         03560         DEFB    168
7F27 AA         03570         DEFB    170
7F28 B3         03580         DEFB    179
7F29 BD         03590         DEFB    189
7F2A B2         03600         DEFB    178
7F2B B1         03610         DEFB    177
7F2C B0         03620         DEFB    176
7F2D B8         03630         DEFB    184
7F2E AF         03640         DEFB    175
7F2F AE         03650         DEFB    174
7F30 AD         03660         DEFB    173
7F31 A6         03670         DEFB    166
7F32 A7         03680         DEFB    167
7F33 B7         03690         DEFB    183
7F34 B6         03700         DEFB    182
7F35 BF         03710         DEFB    191
7F36 BC         03720         DEFB    188
7F37 B4         03730         DEFB    180
7F38 BB         03740         DEFB    187
7F39 B9         03750         DEFB    185
7F3A A9         03760         DEFB    169
7F3B BE         03770         DEFB    190
7F3C AB         03780         DEFB    171
7F3D BA         03790         DEFB    186
7F3E AC         03800         DEFB    172
7F3F 5B         03810         DEFB    91
7F40 5C         03820         DEFB    92
7F41 5D         03830         DEFB    93
7F42 5E         03840         DEFB    94
7F43 5F         03850         DEFB    95
7F44 60         03860         DEFB    96
7F45 8A         03870         DEFB    138
7F46 97         03880         DEFB    151
7F47 95         03890         DEFB    149
7F48 8C         03900         DEFB    140
7F49 82         03910         DEFB    130
7F4A 8D         03920         DEFB    141
7F4B 8E         03930         DEFB    142
7F4C 8F         03940         DEFB    143
7F4D 87         03950         DEFB    135
7F4E 90         03960         DEFB    144
7F4F 91         03970         DEFB    145
7F50 92         03980         DEFB    146
7F51 99         03990         DEFB    153
7F52 98         04000         DEFB    152
7F53 88         04010         DEFB    136
7F54 89         04020         DEFB    137
7F55 80         04030         DEFB    128
7F56 83         04040         DEFB    131
7F57 8B         04050         DEFB    139
7F58 84         04060         DEFB    132
7F59 86         04070         DEFB    134
7F5A 96         04080         DEFB    150
7F5B 81         04090         DEFB    129
7F5C 94         04100         DEFB    148
7F5D 85         04110         DEFB    133
7F5E 93         04120         DEFB    147
7F5F 7B         04130         DEFB    123
7F60 7C         04140         DEFB    124
7F61 7D         04150         DEFB    125
7F62 7E         04160         DEFB    126
7F63 7F         04170         DEFB    127
0000            04180         END     STARTS
00000 TOTAL ERRORS
```

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● Circle No. 201

Atom insert

THE SCREEN EDITOR of the Acorn Atom is effective for replacement and deletion, but insertion, particularly multiple insertion, can be a fiddly business. I frequently end up relisting the line to make sure that it has been correctly edited, confesses Chris Cytera of Bristol.

The problem lies in the lack of visible indication of the characters actually in the input line buffer. It is left up to the programmer to remember which characters have been copied and then typed over to achieve insertion. This program is designed to overcome the problem by providing an insert key similar to that found on the Commodore Pet and Vic computers. Ctrl-Q is the ASCII code that has been chosen, since Q also happens to be nearby, and Ctrl-Q is not one of the control codes used by the Atom.

To use the program, type in and assemble it in the usual way. The machine code occupies addresses # 28A8 to # 28FF, which means that floating-point variables can be used, though only the floating-point arrays from %@@ to %EE can be used without corrupting the code.

Link # 28A8 initialises the insert routine. When editing, use the normal techniques until you reach the position on the line where you wish to insert something. Now press Ctrl-Q: all the characters following the cursor plus the character underneath it will be moved along one position. This happens to the current line and to the line underneath. Type the character to be inserted, and Copy/edit the rest of the line as usual.

Atom insert.

```
 10 REM INSERT
 20 E=£90
 30 DIM EE5
 40 F.I=0 TO 5; EEI=-1;N.
 50 P.$21
 60 F.O=1 TO 2
 70 P=£28A8
 80[
 90:EE0 \ INITIALISE
100 LDA @EE1&£FF INSTALL NEW VECTOR
110 STA £20A
120 LDA @(EE1/256)&£FF
130 STA £20B
140:EE5 RTS
150:EE1 \ GET CHAR
160 JSR £FE94
170 CMP @£11 CTRL-Q ?
180 BNE EE5  NO, RETURN
190 LDY £E0  REMOVE CURSOR
200 LDA (£DE),Y
210 EOR @£80 INVERT
220 STA (£DE),Y
230 LDA £DE  SAVE CU ADDR
240 STA E    CHAR ORIGIN
250 STA E+2  CHAR DESTINATION
260 LDA £DF
270 STA E+1
280 STA E+3
290 TYA      TEST BIT 6
300 BVC EE3  CU ON TOP HALF OF LINE PAIR
310 AND @£3F MASK OFF BITS 6 & 7
320 PHA
330 LDA E
340 CLC
350 ADC @£40
360 STA E
370 STA E+2
380 BCC EE2
390 INC E+1
400 INC E+3
410:EE2 PLA
420:EE3 STA E+4 LAST CHAR +1 OF INSERTION
430 DEC E+4 LAST CHAR
440 LDY @£40 END OF LINE
450 INC E+2  DEST=ORG+1
460:EE4 LDA (E),Y GET CHAR
470 STA (E+2),Y MOVE ALONG ONE
480 DEY
490 CPY E+4  LAST CHAR ?
500 BNE EE4
510 LDY £E0
520 LDA @£A0 CU WHITE BLOCK
530 STA (£DE),Y
540 LDY £E5  RESTORE Y
550 JMP EE1  GET ANOTHER CHAR
560]
570 N.O
580 P.$6
590 E.
```

When the program is working correctly, save it by

*SAVE "INSERT" 28A8 2900

It can then be *RUN directly from tape.

In order to keep the program simple, it is assumed that the top half of a wrap around line is being edited. If this is not the case, the line not being edited immediately below the current line is also moved along. This is a trivial flaw, and would in any case be quite difficult to remove.

The routine works by redirecting OSRDCH to # 28A8. If Ctrl-Q has been pressed, the cursor is first removed by inverting the character it is positioned over. There then follows a routine to find the address on the screen of the last character of the longest possible wrap around line — lines with numbers from 0 to 9 excepted. The characters are then moved along until the address of the cursor is encountered, when the cursor is reinstated and the program loops back to OSRDCH to get another character. The reason for this is to prevent the Ctrl-Q character being sent down to the input line buffer, which would cause errors.

The program could be improved by providing some means of detecting the end of the Basic line being edited, whatever its length. Only the characters in this line would then be moved. The routine would require some sort of marker on the screen to indicate the end of the line. A good candidate is ASCII character # A0, which appears on the screen as a space, making it invisible. It will be necessary to write a routine to put these markers at the end of each program line: this could be done by intercepting OSWRCH and printing one of these pseudospaces immediately before a carriage return is executed. The markers would then appear at the end of the program lines after a List, and would be used by the insert program to find the end of the line. Only the characters between the marker and the cursor would then be moved.

Atom animated graphics

THIS ROUTINE for the Acorn Atom simplifies the writing of programs containing animated graphics, writes Carl-Gustav Werner of Malmö, Sweden. It enables you to define up to 32 figures with a size not exceeding eight by eight pixels in graphics mode 4, and then plot them at an arbitrary position on the screen.

In line 40 the program asks where you want to have the routine. You answer with a number bigger than Top — given by line 30 — and below the upper limit of lower text space minus 370, depending on how big the main program will be. In line 190 the program asks if you want to test a figure or design a new one. If you decide to test a figure, just type T and then the number of the figure and the figure itself will appear on the screen and run around for a while. After the figure has stopped,

(continued on page 165)

Atom animated graphics.

```
10 REM FIGURE 82-08-27
15 P=0;@=P
20 DIMVV4,K8,C1,P(-1)
25 FORA=0TO4;VVA=  #3333;N.
30 P.$12"TOP=  #"&P'
40 IN."WHERE DO YOU WANT TO HAVE THE ROUTINE"B
80 FORD=0TO1;P=B;P.$21;[
85 STX #5A;STY #5C;LDY@0;STY #AA;LDY@0;STY #AB;LDY@0;STY #5B;STY
   #AF
90 STY #5D;LDY@2;STY #5E;ASLA;ASLA;ASLA
95 CLC;ADC #AA;STA #AA;BCCVV0;INC #AB;:VV0 TXA;AND@7;STA #AC
100 JSR #F7AA;JSR #F7AA
120 LDY@ #FF;:VV1 INY;LDA(#AA),Y;LDX@0;STX #AD;LDX #AC
125 CPX@0;BEQVV3
130 :VV2 CLC;RORA;ROR #AD;DEX;BNEVV2
132 :VV3 STA #AE;AND(#5F,X);ORA #AF;STA #AF;LDA #AE
135 EOR(#5F,X);STA(#5F,X);INC #5F
137 LDA #AD;AND(#5F,X);ORA #AF;STA #AF
140 LDA #AD;EOR(#5F,X);STA(#5F,X)
150 LDA #5F;CLC;ADC@31;STA #5F;BCCVV4;INC #60;:VV4 CPY@7;BNEVV1
160 RTS;]
170 N.;P.$6
180 B?5=P;B?9=P/256;DO
```

(listing continued on page 165)

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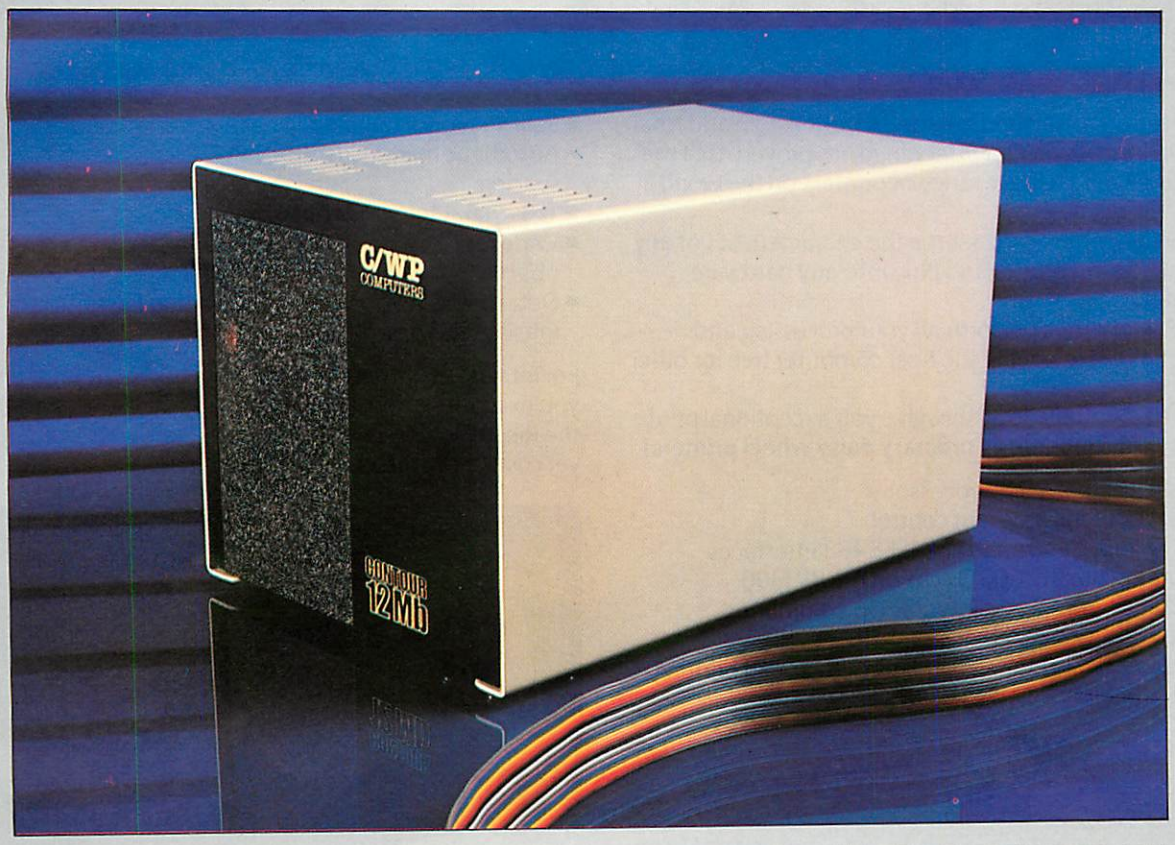

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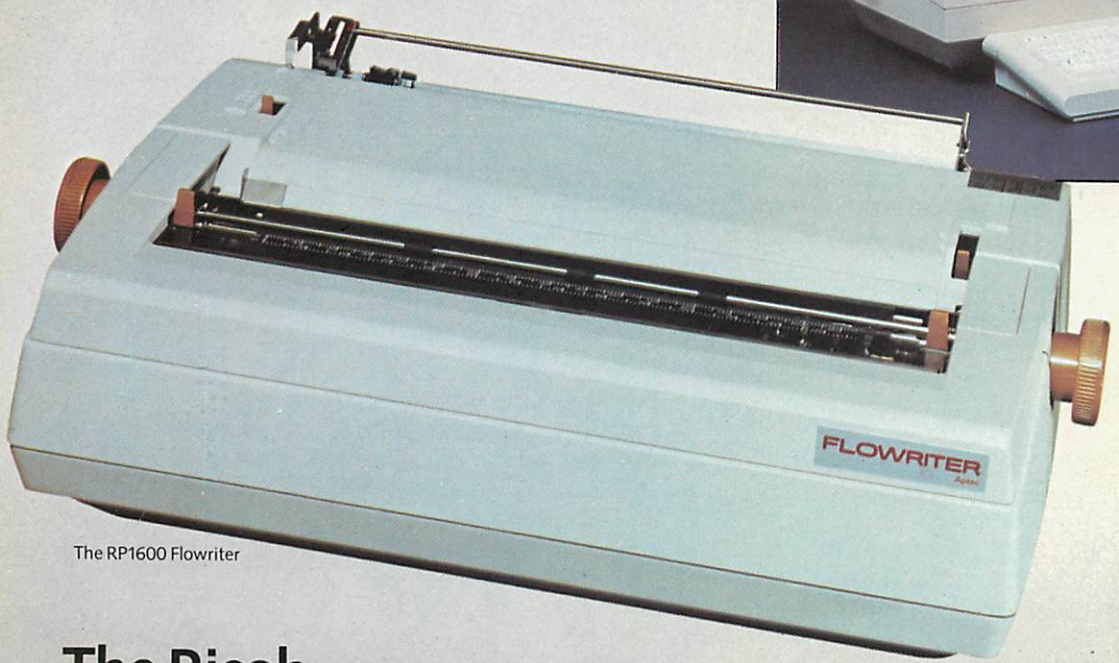

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● Circle No. 205

(continued from page 160)

hit any key to return to line 190.

If you want to design a new figure, type D and the number it will have. A row of eight points then appears, each of them representing a pixel in the top row of the eight-by-eight square. To set a pixel, hit any key; to unset a pixel, hit the spacebar, or use Return if all the following pixels on that row is to be unset. When all eight rows are finished you can test the figure.

To use the routine from another program, JSR or Link to the start address of the routine. The accumulator or variable should contain the number of the figure, and the X and Y registers or the variables X and Y should contain the co-ordinates where the figure is to be plotted. No check is made to check that the position is within the screen, so avoid plotting outside the screen. If you find the noise disturbing, add a line:

```
98 JSR #FE66
```

but the routine will then run considerably more slowly. Do not try to shorten the apparently clumsy construction in line 85; the zeroes are changed by line 180.

The routine EOrs the figure with the screen memory, so that it can be used both for plotting and erasing the figure, as you can see in line 420 to 440. A hit-check is included, which will leave zero in location # AF if no hit has occurred and a non-zero value if a hit has occurred. It is used in line 440 to stop the test routine. It should only be used after plotting a figure, not after erasing it.

The routine requires 114 bytes plus eight bytes for each of the figures. The routine may be used not only to move spaceships and such things, but also to display scores and shorter messages.

(listing continued from page 160)

```
190 IN."DO YOU WANT TO TEST OR DESIGN A NEW FIGURE (T/D)"$C
200 IN."WHICH FIGURE"F
210 IF?C<>CH"D" G.a
220 G=P+F*8
230 FORH=G TOG+7
235 $K="      "
240 P."....."$13;IN.$K
250 I=128;?H=0
260 FORJ=0TO7;IFK?J<>32 IFK?J<>13;?H=?H+I
270 I=I/2;N.;N.;U.0
400aCLEAR4
405 MOVE 128,0;DRAW128,150
410 X=150;Y=120;A=F;LINK B
420 Y=100;FORX=18TO240;LINK B;WAIT;LINK B;N.
430 FORY=100TO20 S.-1.LINK B;WAIT;LINK B;N.
440 LINK B;DOWAIT;LINK B;X=X-1;LINK B; U.? #AF<>0
450 P.$7;LINK #FFE3;P.$12;U.O
```

Shoot to win.

```
10 REM*****************************************
20 REM** SHOOT OUT                            ***
30 REM** By Simon Talbot                      ***
40 REM** FOR USE WITH UK101 AND NEW MONITOR   ***
50 REM** WRITTEN 30/11/81                     ***
60 REM*****************************************
70 REM
80 REM
90 REM
100 L=0
110 R=0
120 PRINT CHR$(12)
130 REM**PRINT INSTRUCTIONS**
140 PRINT TAB(17);"'SHOOT OUT'"
150 PRINT TAB(17);"==========="
160 PRINT"SHOOT YOUR OPPONENT,THE CONTROLS FOR BOTH"
170 PRINT"PLAYERS ARE:"
180 PRINT"    ","LEFT","RIGHT"
190 PRINT"    ","====","====="
200 PRINT"UP  "," 1  "," B   "
210 PRINT"DOWN"," 2  "," N   "
220 PRINT"FIRE"," 3  "," M   "
230 PRINT:PRINT"EACH PLAYER HAS 20 BULLETS"
240 PRINT"IF YOUR GUNMAN LEAVES THE FIELD YOUR OPPONENT"
250 PRINT"WINS THE ROUND.THERE ARE 15 ROUNDS"
260 PRINT"TO QUIT HIT    'RETURN'"
270 PRINT"          TYPE'C' TO CONTINUE."
280 POKE 530,1:POKE 57088,251
290 IF PEEK(57088)=191 THEN 310
300 GOTO 280
310 PRINT CHR$(12)
320 B1=-1:B2=-1
330 M1=53453:M2=54070
340 FOR A=53260 TO 53305:POKEA,161:NEXT
350 FOR A=53259 TO 54156 STEP 64:POKE A,161:NEXT
360 FOR A=53260 TO 54157 STEP 64:POKE A,161:NEXT
370 FOR A=54219 TO 54264:POKE A,161:NEXT
380 FOR A=53303 TO 54261 STEP 64:POKE A,161:NEXT
390 FOR A=53304 TO 54262 STEP 64:POKE A,161:NEXT
400 POKE M1,29:POKE M2,29
405 POKE 53325,32
410 M3=M1:M4=M2
420 POKE 530,1:POKE 57088,127:IF PEEK(57088)=127 THEN M3=M1-64
430 POKE 57088,251:IF PEEK(57088)=239 THEN M4=M2-64
440 POKE 57088,127:IF PEEK(57088)=191 THEN M3=M1+64
450 POKE 57088,251:IF PEEK(57088)=247 THEN M4=M2+64
460 POKE 57088,127:IF PEEK(57088)=223 THEN 560
470 POKE 57088,251:IF PEEK(57088)=251 THEN 690
480 POKE 57088,223:IF PEEK(57088)=247 THEN 1010
490 IF M3=53325 OR M3=54157 THEN 840
500 IF M4=53366 OR M4=54198 THEN 890
510 POKE M3,29:POKE M4,29
520 POKE M3-64,32:POKE M3+64,32
530 POKE M4-64,32:POKE M4+64,32
540 M1=M3:M2=M4
550 GOTO 420
560 B2=B2+1
570 IF B2=20 THEN PRINT CHR$(12);"OUT OF BULLETS MR LEFT"
580 IF B2=20 THEN R=R+1
590 IF B2=20 THEN 940
600 FOR A=M3+2 TO M3+41:POKE A,18:POKEA-1,32:NEXT
610 POKE A-1,32
620 IF A-1=M4 THEN L=L+1
630 IF A-1=M4 THEN PRINT
640 IF A-1=M4 THEN PRINT
650 IF A-1=M4 THEN PRINT TAB(10);
660 IF A-1=M4 THEN PRINT"MR RIGHT GOT SHOT"
670 IF A-1=M4 THEN 940
680 GOTO 410
690 B1=B1+1
700 IF B1=20 THEN PRINT CHR$(12);"OUT OF BULLETS MR RIGHT"
710 IF B1=20 THEN L=L+1
720 IF B1=20 THEN 940
730 FOR A=M4-2 TO M4-41 STEP-1:POKE A,22:POKE A+1,32:NEXT
740 POKE A+1,32
750 IF A+1=M3 THEN R=R+1
760 IF A+1=M3 THEN PRINT
770 IF A+1=M3 THEN PRINT
780 IF A+1=M3 THEN PRINT
790 IF A+1=M3 THEN PRINT TAB(10);
800 IF A+1=M3 THEN PRINT"MR LEFT GOT SHOT."
810 IF A+1=M3 THEN 940
820 GOTO 420
830 END
840 PRINT CHR$(12);"YOU WENT OFF THE SCREEN MR LEFT"
850 PRINT"MR RIGHT WINS"
860 R=R+1
870 GOTO 940
880 END
890 PRINT CHR$(12);"YOU WENT OFF THE SCREEN MR RIGHT"
900 PRINT"MR LEFT WINS"
910 L=L+1
920 GOTO 940
930 END
940 FOR A=1 TO 5000:NEXT
950 PRINT CHR$(12)::PRINT:PRINT"MR LEFT";L;"MR RIGHT";R
960 IF R=15 THEN PRINT"MR RIGHT WINS"
970 IF L=15 THEN PRINT"MR LEFT WINS"
980 IF L=15 OR R=15 THEN END
990 FOR A=1 to 1000:NEXT
1000 GOTO 310
1010 PRINT CHR$(12);"MR LEFT";L;"MR RIGHT";R
1020 PRINT:PRINT:PRINT"BYE"
1030 END
```

Shoot to win

SHOOT OUT by Simon Talbot of Garston, Hertfordshire has been written for the 8K UK101 with the monitor chip. Designed for two players, the program produces a field of play with a gunman on either side. Each gunman has 20 shots at his opponent, scoring a point for each hit, when his opponent leaves the field of play, and when the opponent runs out of bullets. Each of these events is displayed on the screen. When a player has scored 15 points both scores are displayed and that game ends. At any time before the end, hitting Return quits the game and displays the score to date.

The field of play is set up by lines 340 to 390. Users of other machines may need to alter the Poke locations and change the starting positions of the two gunmen in line 330.

Lines 420 to 480 scan the keyboard for player action, but you can use a Get statement, if you have it, to cut this down considerably. Lines 490 and 500 check whether either man has left the screen; if one has then the fact is displayed by subroutine 840 for M1 or 890 for M2. Lines 460 and 470 read the keyboard and routes to either subsection 560 for M1 or 690 for M2 to activate their fire sequence.

The number of bullets allowed may be changed by altering B1 and B2 in line 320; −1 provides 20 shots, 0 provides 19 shots, etc. The number of games may be altered by changing lines 960 to 980 to suit any chosen number.

Subroutines 560 and 690 count the shots and operate the display when one player has run out of bullets. It also checks whether either man has been shot at the end of the bullet run. After checking lines 490 and 500, subroutines 840 and 890 display when a player has left the field of play. Subroutine 940 accumulates the score to the total decided in lines 100 and 110 and displays the winner.

Save command.

```
10 CLEAR:FORX=0TO31:PRINT:NEXT
15 CS="":GS=""
20 PRINTSPC(10)"SAVE ROUTINE FOR MONITOR
21 FORX=0TO16:PRINT:NEXT
22 DATA32,237,254,141,51,2,32,147,254,201,128,240,243,141,52,2,96
23 DATA165,65,41,240,141,95,2,165,65,41,15,141,96,2,96
24 FORX=546TO562:READC:POKEX,C:NEXT
25 FORX=592TO606:READC:POKEX,C:NEXT
30 PRINT"START ADDRESS : ";
40 F=1:GOSUB1000:B=H
46 PRINT:PRINT:PRINT"RELOCATION ADDRESS : ";
47 F=0:GOSUB1000
50 PRINT:PRINT:PRINT"FINISH ADDRESS : ";
51 F=1:GOSUB1000
52 PRINT:PRINT:INPUT"LOAD AND GO ";YS:YS=LEFT$(YS,1)
53 IFYS<>"Y"THEN57
54 PRINT:PRINT"ENTRY POINT : ";:IF=01YS=CS:CS="":IY=H
55 GOSUB1000:GS=CS:CS+YS:IF=Y
56 PRINT
57 PRINT:PRINT"HIT ANY KEY WHEN READY
61 POKE11,0:POKE12,253:X=USR(X)
62 PRINT:PRINT:PRINT"*** Saving ***
65 SAVE
70 PRINT."C$"/";
80 GOSUB2000
90 B=B+1:IFB<>HTHEN80
95 IFGS<>""THENPRINT"."GS"0"
100 POKE517,0
110 PRINT:PRINT"*** Finished ***
112 PRINT:PRINT"HIT ""C/""" TO EXIT
120 POKE11,0:POKE12,253:X=USR(X)
130 IFPEEK(533)<>27THEN130
140 END
1000 POKE11,36:POKE12,2
1002 H=0
1005 FORX=1TO4
1010 X=USR(X)
1015 IFF=0THENCS=CS+CHR$(PEEK(561))
1020 PRINTCHR$(PEEK(561));
1025 H=H*16+PEEK(564)
1030 NEXT
1040 RETURN
2000 POKE11,80:POKE12,2
2005 X=PEEK(0):POKE5,X
2010 X=USR(X)
2020 X=PEEK(607):Y=PEEK(608)
2025 X=X*16
2030 X=X+44:IFX>57THENX=X+7
2040 Y=Y+44:IFY>57THENY=Y+7
2050 XS=CHR$(X):YS=CHR$(Y)
2060 PRINT#5""YS
2070 RETURN
OK
```

Save command

A PROBLEM with the Superboard II monitor is that it has no Save routine, writes Martin Sexton of Camberley, Surrey. This will allow the user to store, relocate blocks storage and even execute immediately after the program has been loaded. To load the user must enter the monitor and type L.

The program uses two machine-code routines at locations 0222 to 0232 and 0250 to 025E. Users who want to use these areas must first copy it to another area of store then set the relocation address to the desired location.

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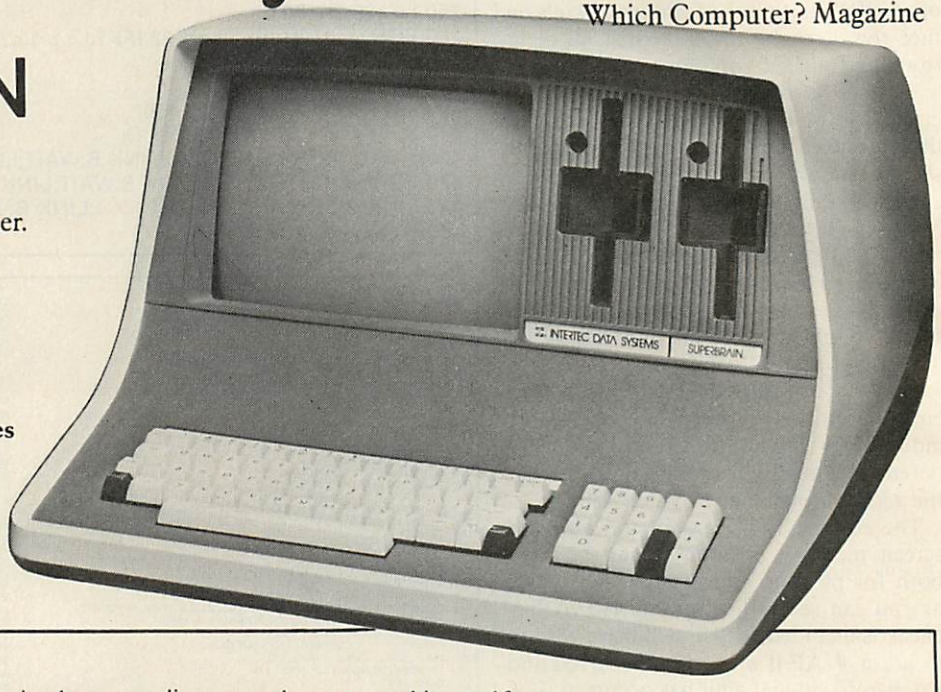

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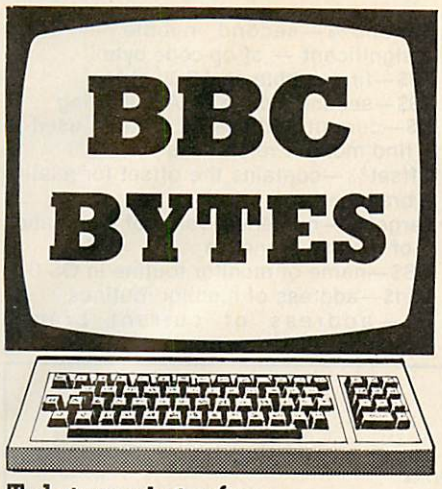


Teletype interface

THE BBC MICRO has facilities for driving both serial and parallel printers but cannot drive the older Teletype machines, remarks I L Collings of Newport Pagnell, Buckinghamshire. This is a pity, as large numbers of Teletype printers are now available extremely cheaply as firms switch to high-speed printers.

Together with a short assembler program, a simple interface enables a BBC model B — or model A with user port — to drive a Teletype at 110 baud. Enter and run the program. From then on pressing function key 9 will enable the Teletype; all output to the screen is printed. Key 8 disables the Teletype. Line 650 should only be included once the program has been run and checked for errors

As the routine is located at &0D00 new programs can be loaded and run, while the operator activates the routine when printing is required. To operate the routine within a program include the following lines:

```
WIDTH 65: ?&020E = 0:?&020F =
  &0D:&FE62 = &FF:?&FE60 = 0: REM
  ENABLE TELETYPE
```

and

```
WIDTH 0:?&020E = 187: ?&020F = 225:
REM DISABLE TELETYPE
```

The routine interrupts the OSWRCH routine by resetting the WRCHV vectors. The character to be output is placed on the user port and is then rotated bit by bit, with a delay, so that it appears in serial form at bit 0 of the user port. By adding start and stop bits and setting the correct delay, a serial output of 11 bits — one start, eight data and two stop — is obtained. A delay to allow carriage return is also included.

The hardware interface changes the +5V at the user port to 20mA needed by the Teletype.

Letter writer

LETTER WRITER by Paul Eaton of Colchester, Essex uses word processing to produce letters in a standard format which can be viewed, edited and then printed out. Any number of copies may be printed.

The user is asked for the date and the name and address of the person the letter is being sent to. For a business letter the user should type in Sir or Sirs as the addressee's name; the letter will then automatically end with "Yours faithfully". In other cases it will end with "Yours sincerely", of course. The text of the letter is then typed in using mode 3, which gives the standard 80 characters per line for the printer. The whole letter is then displayed in its final format with the user's pre-programmed name, address and phone number automatically printed at the top right. For long letters, Page mode is used. Editing is made easy because the required line is printed out and can be edited using the cursor keys. The letter may then be printed out and, if necessary, re-edited.

The program uses 0B2B hex blocks of memory and runs on an upgraded model A machine. It works with a standard Centronics printer but would run on a serial printer using the commands *FX5,2 followed by *FX6 and *FX7 as explained in the user guide.

Disassembler

THE ON-BOARD assembler is a valuable feature of the BBC Micro. This Basic program by A K A Kerr of Holly Lodge School, Liverpool provides the converse, a disassembler which should help you to understand the workings of the monitor or of any of the numerous machine-code programs which are now available. As it stands, the program occupies 5.1K but can easily be shortened by removing Rems and using multiple-statement lines.

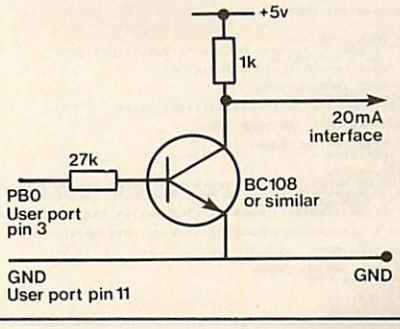
The program examines a memory location and, depending on its contents, identifies the instruction as being one, two or three bytes long. The relevant number of bytes are printed out together with the mnemonic. Two-byte relative branches are identified and the offset used to calculate the target address which is printed out. Three-byte instructions using absolute adressing are checked against a list of OS 0.1 monitor routines and the name printed if a match is found. The program halts if it encounters an unknown op code as the first byte of an instruction.

The program has not been optimised

(continued on next page)

Teletype interface.

```
   10  REM ==============================
   20  REM BBC TELETYPE DRIVER (110 BAUD)
   30  REM
   40  REM T L COLLINGS AUGUST 1982
   50  REM ==============================
   60  *KEY9"WIDTH 65M ?&020E=0:?&020F=&0D:?&FE62=255:?&FE60=0
M CLSM"
   70  *KEY8"WIDTH 0M ?&020E=187:?&020F=225M CLSM"
   80  FOR PASS=0 TO 3  STEP 3
   90     P%=&0D00:PORT=&FE60
  100     [OPT PASS
  110     . START
  120  STA &70
  130  PHA            \STORE REGISTERS
  140  TXA            \ON STACK
  150   PHA
  160   TYA
  170   PHA
  180   SEI           \LOCK OUT INTERUPTS
  190   LDA #7        \BIT COUNTER
  200   STA &71
  210  LDA#0
  220  STA PORT       \SEND START BIT
  230  JSR DELAY
  240  LDA &70
  250  STA PORT       \SEND BIT0
  260   .SQUIRT       \SEND BITS 1-7
  270  JSR DELAY
  280  ROR PORT
  290   DEC &71
  300   BNE SQUIRT
  310  JSR DELAY
  320  LDA #1
  330  STA PORT       \SEND 2 STOP BITS
  340  JSR DELAY
  350  JSR DELAY
  360  LDA &70
  370  CMP #13        \CHECK FOR CR
  380   . BNE OUT      \IF NOT EXIT
  390    LDA #20
  400    STA &71
  410    .CR-DELAY     \DELAY ROUTINE
  420    JSR DELAY     \TO ALLOW CR
  430    DEC &71
  440    BNE CR-DELAY
  450    .OUT
  460    CLI           \RESET INTERUPTS
  470    PLA
  480    TAY           \RESTORE REGISTERS
  490    PLA
  500    TAX
  510    PLA
  520    JMP &E1BB     \JUMP TO SCR DISP.
  530    .DELAY
  540    LDX #59       \DELAY TO SET BAUD
  550    .LOOP2        \RATE
  560    LDY#60
  570    .LOOP1
  580    DEY
  590    BNE LOOP1
  600    DEX
  610    BNE LOOP2
  620    RTS
  630    ]
  640    NEXT PASS
  650   NEW
```



(continued from previous page)

for speed since it was designed to operate in conjunction with a relatively slow printer, without significant buffer.

The main variables are:

J%—loop counter
G%—loop counter
Mnem$—mnemonic
OpCode%—hexadecimal op code value
Len%—length of instruction, one two or three bytes
Base%—address to disassemble from
End%—final address to be disassembled
AA%—pointer to current memory location
Byte%—contents of location AA%
Q%—used to test if an op-code match has been made
B$—contents of AA% as an ASCII string
C$—contents of AA%+1 as an ASCII string
D$—contents of AA%+2 as an ASCII string
T1%—contents of AA%+1
T2%—contents of AA%+2
P7$—op code as a hexadecimal string
First%—first nybble — most significant — of op-code byte
Second%—second nybble — least significant — of op-code byte
P8$—first nybble as ASCII string
P9$—second nybble as ASCII string
Q$—current address as a string used to find monitor references
Offset%—contains the offset for relative branches
Target%—numerical value of destination of relative branches
OS$—name of monitor routine in OS 0.1
add$—address of monitor routines
E$—address of current branch destination as a string

Letter writer.

```
  10  DIM A$(10),M$(50),H$(5)
  20  MODE 7
  30  PRINT'"  'LETTERS' enables you to write a"
  40  PRINT"letter onto the screen, edit it if"
  50  PRINT"necessary and Print out any number of"
  60  PRINT"copies.  Your name and address should"
  70  PRINT"be Pre-Programmed. The letter will then"
  80  PRINT"be Printed in standard format.  When"
  90  PRINT"entering the address, Press 'return'"
 100  PRINT"after each line and 'end' as the last "
 110  PRINT"line.  Similarly, when entering text,"
 120  PRINT"Press 'return' at the end of each line"
 130  PRINT"on the screen and type 'end' as the"
 140  PRINT"last line."
 150  PROCHEADING
 160  PRINTTAB(0,18)"Enter the date now:                "
 170  INPUT TAB(21,18)D$
 180  PRINTTAB(0,20)"Date correct?  Type Y or N:        "
 190  INPUT TAB(29,20)G$:IF G$="N" THEN 160
 200  IF G$<>"Y" THEN 180
 210  M=0:N=0
 220  PROCADDRESS
 230  MODE 3
 240  PROCTEXT
 250  PROCDISPLAY
 260  MODE 7
 270  END
 280  DEFPROCADDRESS
 290  CLS:PRINT
 300  INPUT"Addressee's name: "N$
 310  N=1:INPUTLINE'"Address          :"A$(N)
 320  REPEAT N=N+1
 330    INPUTLINE"                    "A$(N)
 340    UNTIL A$(N)="END" OR A$(N)="End" OR A$(N)="end"
 350  ENDPROC
 360  DEFPROCTEXT
 370  PRINT''"Enter text:"'TAB(LEN(N$)+6);
 380  INPUTLINE M$(1)
 390  M=1
 400  REPEAT M=M+1
 410    INPUTLINE M$(M)
 420    UNTIL M$(M)="END" OR M$(M)="End" OR M$(M)="end"
 430  ENDPROC
 440  DEFPROCDISPLAY
 450  VDU 14
 460  PROCletter
 470  VDU 15
 480  PRINT''''"Type 'P' for a Print out, 'E' to edit, 'R' to re-run or 'F' to
finish."
 490  PRINT"Type 'M' for a multiple Printout."
 500  G$=GET$:PRINT G$;H$=GET$:IF G$="P" THEN PROCTYPE:PROCDISPLAY
 510  IF G$="M" THEN PROCMULT
 520  IF G$="E" THEN PROCEDIT
 530  IF G$="R" THEN RUN
 540  IF G$<>"F" AND G$<>"E" AND G$<>"P" AND G$<>"R" AND G$<>"M" THEN 500
 550  ENDPROC
 560  DEFPROCletter
 570  CLS
 580  PRINTTAB(50);P$
 590  PRINTTAB(50);H$(1)
 600  PRINTTAB(50);H$(2)
 610  PRINTTAB(50);H$(3)
 620  PRINTTAB(50);H$(4)
 630  PRINTTAB(50);TEL$
 640  FOR I=1 TO N-2
 650    PRINT A$(I)
 660    NEXT
 670  PRINTA$(N-1);TAB(50);D$
 680  PRINT'"Dear "N$","
 690  C=COUNT
 700  PRINT'TAB(C);M$(1)
 710  FOR I=2 TO M-1
 720    PRINT M$(I)
 730    NEXT
 740  IF N$="Sir" OR N$="Sirs" OR N$="SIR" OR N$="SIRS" THEN PRINT'TAB(30);"Yo
urs faithfully," ELSE PRINT'TAB(30);"Yours sincerely,"
 750  ENDPROC
 760  DEFPROCTYPE
 770  VDU 2:PROCletter:PRINT'''''':VDU 3
 780  ENDPROC
 790  DEFPROCHEADING
 800  P$="A.N. Other,"
 810  H$(1)="57, The Elder,"
 820  H$(2)="King Street,"
 830  H$(3)="Newtown,"
 840  H$(4)="Essex."
 850  TEL$="Tel: Newtown 1234"
 860  ENDPROC
 870  DEFPROCEDIT
 880  PRINT"Type: 1 to edit the name,"
 890  PRINT"      2 to edit the address,"
 900  PRINT"      3 to edit the text,"
 910  PRINT"      4 to edit the date."
 920  G$=GET$:PRINT G$;"     ";:H%=GET$:X=VAL(G$)
 930  IF X=1 THEN INPUT"Enter name: "N$
 940  IF X=2 THEN PROCEDITADDRESS
 950  IF X=3 THEN PROCEDITTEXT
 960  IF X=4 THEN INPUT"Enter date: "D$
 970  IF X<1 OR X>4 THEN 920
 980  PROCDISPLAY
 990  ENDPROC
1000  DEFPROCEDITTEXT
1010  PRINT"Enter the number of the line you wish"
1020  INPUT"to edit: "EDIT IF EDIT<0 OR EDIT>M THEN 1010
1030  PRINT" ";M$(EDIT)'"Enter the amendment:"
1040  IF EDIT=1 THEN PRINTTAB(C);
1050  INPUTLINE M$(EDIT)
1060  ENDPROC
1070  DEFPROCEDITADDRESS
1080  PRINT"Enter the number of the line you wish"
1090  INPUT"to edit: "EDIT IF EDIT<0 OR EDIT>N THEN 1080
1100  PRINT" ";A$(EDIT)'"Enter the amendment:"
1110  INPUTLINE A$(EDIT)
1120  ENDPROC
1130  DEFPROCMULT
1140  INPUT"Number of copies",N
1150  K=0
1160  REPEAT K=K+1
1170    PROCTYPE
1180    UNTIL K=N
1190  PROCDISPLAY:ENDPROC
```

Disassembler.

```
  10 REM
  20 REM ***************************************
  30 REM *                                     *
  40 REM *  A.K.A. Kerr     Holly Lodge School *
  50 REM *          October 1982               *
  60 REM * BBC Microcomputer simple disassembler *
  70 REM *              approx 5K              *
  80 REM ***************************************
  90 REM
 100 REM DIMENSION ARRAYS AND READ IN DATA
 110 :
 120 DIM OpCode(152), Mnem$(152), Len%(152), OS$(15), add$(15)
 130 J%=1
 140 REPEAT
 150 READ OpCode(J%), Mnem$(J%), Len%(J%)
 160 J%=J%+1
 170 UNTIL J%=152
 180 FOR J%=1 TO 13
 190 READ OS$(J%),add$(J%)
 200 NEXT J%
 210 CLS
 220 INPUT TAB(1,5)"Base Address (DEC) "Base%
 230 IF Base%>65536 OR Base%<1 THEN 210
 240 INPUT TAB(1,7)"End Address (DEC) "End%
 250 IF End%>65536 OR End%<1 OR End%<Base% THEN 210
 260 AA%=Base%
 270 REM EPSON MX80 III F/T PRINTER CODES
 280 VDU2:*FX6,0
 290 VDU1,14
 300 PRINT TAB(8);"6502 DISASSEMBLER    V 0.2"
 310 VDU1,27,2D
 320PRINT''''; TAB(4);"   FROM ";Base% ;"    (DEC)";TAB(29);~Base%;" (HEX)"
 330 PRINT TAB(4);"    TO   ";End% ;"    (DEC)";TAB(29);~End%;" (HEX)"
 340 VDU1,27,45,1
 350 PRINT''''; TAB(4);"Address";TAB(18);"Mnemonic";TAB(30);"Operator  Operand  T
arget";:PRINT
 360 VDU1,27,64
 370 Byte%=?AA%
 380 :
 390 REM SEARCH FOR OP-CODE
 400 RESTORE
 410 Q%=999:J%=1
 420 REPEAT
 430 IF Byte%=OpCode(J%) THEN Q%=J%
 440 J%=J%+1
 450 UNTIL J%=152
 460 IF Q%<>999 THEN GOTO 480
 470 PRINT TAB(5);~AA%;"  Illegal OpCode ";~Byte%:VDU3:STOP
 480 ON Len%(Q%) GOTO 520,580,690
 490 PRINT"  Illegal length field":VDU3:STOP
 500 :
 510 REM SINGLE BYTE INSTRUCTIONS
 520 PROCHEX(Byte%):B$=P7$
 530 PRINT TAB(5);~AA%;TAB(20);Mnem$(Q%);TAB(33);B$
 540 AA%=AA%+1
 550 IF AA%>End% THEN GOTO 780 ELSE 370
 560 :
 570 REM DOUBLE BYTE INSTRUCTIONS
 580 PROCHEX(Byte%):B$=P7$
 590 T1%=?(AA%+1)
 600 PROCHEX(T1%):C$=P7$
 610 IF Byte%=&D0 OR Byte%=&10 OR Byte%=&50 OR Byte%=&B0 OR Byte%=&90 OR Byte%=
&F0 OR Byte%=&30 OR Byte%=&70 THEN PROCRELBRANCH ELSE Target%=0
 620 IF Target%=0 THEN 640 ELSE 630
 630 PRINT TAB(5);~AA%;TAB(20);Mnem$(Q%);TAB(33);B$;TAB(42);C$;TAB(49);~Target%
:GOTO650
 640 PRINT TAB(5);~AA%;TAB(20);Mnem$(Q%);TAB(33);B$;TAB(42);C$
 650 AA%=AA%+2
 660 IF AA%>End% THEN GOTO 780 ELSE 370
 670 :
 680 REM TREBLE BYTE INSTRUCTIONS
 690 PROCHEX(Byte%):B$=P7$
 700 T1%=?(AA%+1)
 710 PROCHEX(T1%):C$=P7$
 720 T2%=?(AA%+2)
 730 PROCHEX(T2%):D$=P7$
 740 PROCMONITOR(C$,D$)
 750 PRINT TAB(5);~AA%;TAB(20);Mnem$(Q%);TAB(33);B$;TAB(42);C$;D$;"   ";E$
 760 AA%=AA%+3
 770 IF AA%>End% THEN GOTO 780 ELSE 370
 780 VDU3:END
 790 :
 800 DEFPROCHEX(N%):P7$=""
 810 REM RANGE 0-255
 820 FIRST%=N% MOD 16
 830 IF FIRST%>9 THEN P9$=CHR$(&41+FIRST%-10) ELSE P9$=STR$(FIRST%)
 840 IF N% DIV 16 =0 THEN P8$="0":GOTO 870
 850 SECOND%=N% DIV 16
 860 IF SECOND%>9 THEN P8$=CHR$(&41+SECOND%-10) ELSE P8$=STR$(SECOND%)
 870 P7$=P8$+P9$
 880 ENDPROC
 890 :
 900 DEFPROCMONITOR(C$,D$):E$=""
 910 Q$="&"   +D$+C$
 920 FOR G%=1 TO 13
 930 IF Q$=add$(G%) THEN E$=OS$(G%):GOTO 960
 940 E$=""
 950 NEXT G%
 960 ENDPROC
 970 :
 980 DEF PROCRELBRANCH :Target%=0
 990 IF T1%>128 THEN 1000 ELSE Target%=AA%+1+T1%:GOTO 1010
1000 Offset%=-(256-T1%):Target%=AA%+1+Offset%
1010 ENDPROC
1020 :
1030 REM OPCODES, MNEMONICS AND INSTRUCTION LENGTHS
1040 DATA &00,BRK ,1,&18,CLC ,1 ,&38,SEC ,1
1050 DATA &D8,CLD ,1,&58,CLI ,1 ,&B8,CLV ,1
1060 DATA &CA,DEX ,1,&88,DEY ,1,&E8,INX ,1,&C8,INY ,1
1070 DATA &EA,NOP ,1,&48,PHA ,1,&08,PHP ,1,&68,PLA ,1
1080 DATA &28,PLP ,1,&2A,ROL ,1,&40,RTI ,1
1090 DATA &78,SEI ,1,&AA,TAX ,1,&A8,TAY ,1,&BA,TSX ,1,&6C,JMP ,3
1100 DATA &8A,TXA,1,&9A,TXS,1,&98,TYA,1
1110 DATA &0A,ASL,1,&4A,LSR,1,&60,RTS,1
1120 DATA &6A,ROR,1,&D,ADC$,3,&2D,AND$,3
1130 DATA &0E,ASL$,3,&2C,BIT$,3,&CD,CMP$,3,&EC,CPX$,3
1140 DATA &CC,CPY$,3,&CE,DEC$,3,&4D,EOR$,3,&EE,INC$,3
1150 DATA &4C,JMP$,3,&20,JSR$,3,&AD,LDA$,3,&AE,LDX$,3
1160 DATA &AC,LDY$,3,&4E,LSR$,3,&0D,ORA$,3,&2E,ROL$,3
1170 DATA &6E,ROR$,3,&ED,SBC$,3,&8D,STA$,3,&8E,STX$,3
1180 DATA &24,BITZ,2,&C5,CMPZ,2,&E4,CPXZ,2,&C4,CPYZ,2
1190 DATA &C6,DECZ,2,&45,EORZ,2,&EA,INCZ,2,&A5,LDAZ,2
1200 DATA &A6,LDXZ,2,&A4,LDYZ,2,&45,LSRZ,2,&05,ORAZ,2
1210 DATA &26,ROLZ,2,&66,RORZ,2,&E5,SBCZ,2,&85,STAZ,2
1220 DATA &86,STXZ,2,&84,STYZ,2,&69,ADCE,2,&29,ANDE,2
1230 DATA &C9,CMPE,2,&E2,CPXE,2,&C0,CPYE,2,&49,EORE,2
1240 DATA &A9,LDAE,2,&A2,LDXE,2,&A0,LDYE,2,&09,ORAE,2
1250 DATA &E9,SBCE,2,&D0,BNE ,2,&10,BPL ,2,&50,BVC ,2
1260 DATA &90,BCC ,2,&B0,BCS ,2,&F0,BEQ ,2,&30,BMI ,2
1270 DATA &70,BVS,2,&8C,STY$,3,&65,ADDZ,3,&25,ADDZ,3,&06,ASLZ,3
1280 DATA &7D,ADC$-X,3,&3D,AND$-X,3,&1E,ASL$-X,3,&DD,CMP$-X,3
1290 DATA &5D,EOR$-X,3,&FE,INC$-X,3,&BD,LDA$-X,3
1300 DATA &BE,LDY$-X,3,&5E,LSR$-X,3,&1D,ORA$-X,3,&3E,ROL$-X,3
1310 DATA &7E,ROR$-X,3,&FD,SBC$-X,3,&9D,STA$-X,3,&79,ADC$-Y,3
1320 DATA &39,AND$-Y,3,&D9,CMP$-Y,3,&59,EOR$-Y,3,&B9,LDA$-Y,3
1330 DATA &BE,LDX$-Y,3,&19,ORA$-Y,3,&F9,RTS$-Y,3,&99,STA$-Y,3
1340 DATA &61,ADC(IND.X),2,&21,AND(IND.X),2,&C1,CMP(IND.X),2,&41,EOR(IND.X),2
1350 DATA &A1,LDA(IND.X),2,&01,ORA(IND.X),2,&E1,SBC(IND.X),2,&81,STA(IND.X),2
1360 DATA &71,ADC(IND)Y,2,&31,AND(IND)Y,2
1370 DATA &D1,CMP(IND)Y,2,&51,EOR(IND)Y,2,&B1,LDA(IND)Y,2,&11,ORA(IND)Y,2
1380 DATA &F1,RTS(IND)Y,2,&91,STA(IND)Y,2
1390 DATA &75,ADCZ,X,2,&35,ANDZ,X,2,&16,ASLZ,X,2,&D5,CMPZ,X,2
1400 DATA &DE,DECZ,X,2,&55,EORZ,X,2,&F6,INCZ,X,2,&B5,LDAZ,X,2
1410 DATA &B4,LDYZ,X,2,&56,LSRZ,X,2,&15,ORAZ,X,2,&36,ROLZ,X,2
1420 DATA &76,RORZ,X,2,&F5,SBCZ,X,2,&95,STAZ,X,2,&94,STYZ,X,2
1430 DATA &B6,LDXZ,Y,2,&96,STXZ,Y,2
1440 DATA &38,SEC,1,&F8,SED,1,&D6,DEC(IND)Y,2
1450 REM MONITOR CALLS - NAMES AND ADDRESSES FOR O.S. 0.1
1460 DATA OSFIND,&FFCE,OSGPB,&FFD1,OSBPUT,&FFD4,OSBGET,&FFD7,OSARGS,&FFDA,OSFIL
E,&FFDD
1470 DATA OSRDCH,&FFE0,OSASCI,&FFE3,OSNEWL,&FFE7,OSWRCH,&FFEE,OSWORD,&FFF1
1480 DATA OSBYTE,&FFF4,OSCLI,&FFF7
```

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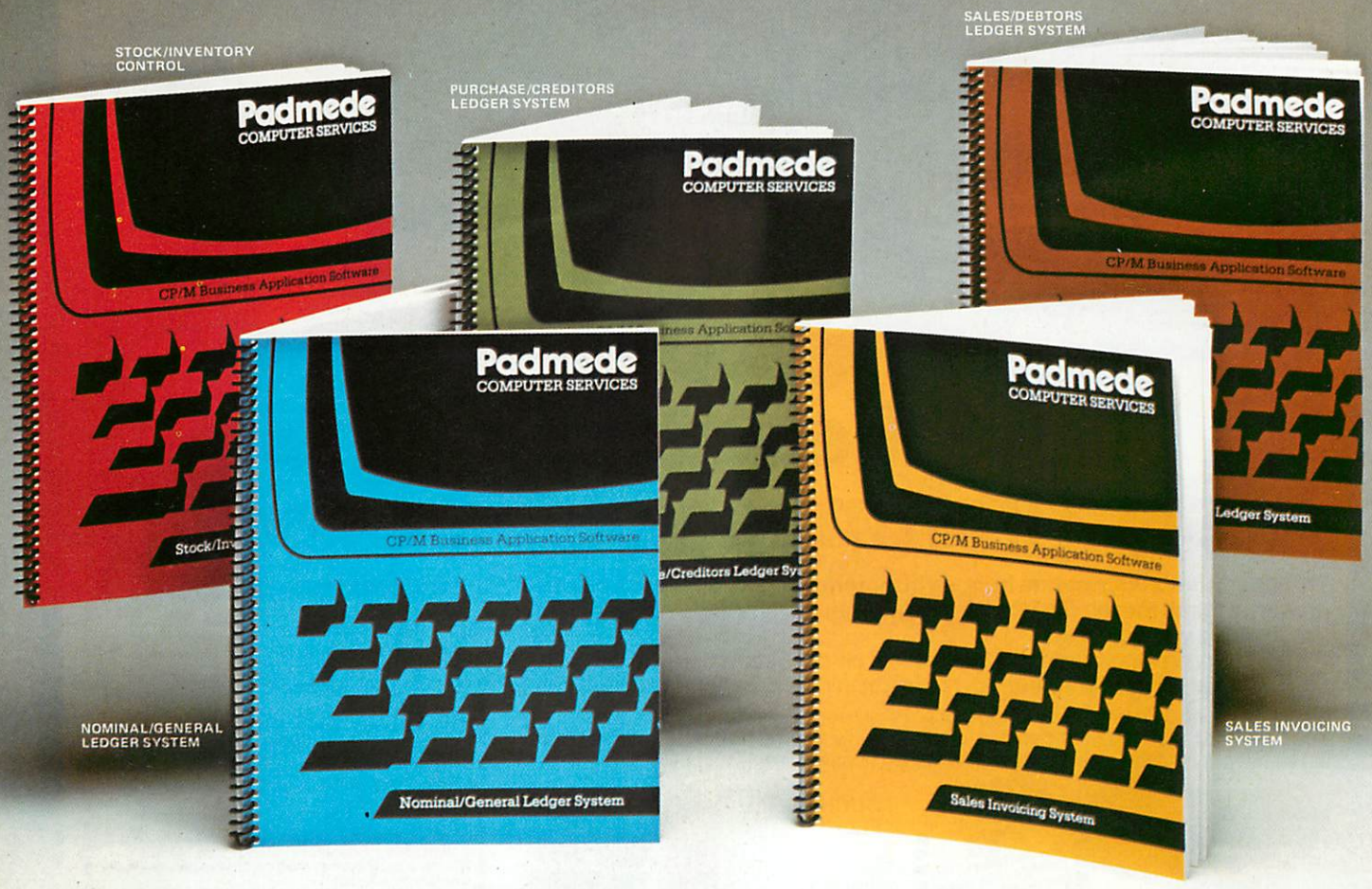

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Fourier Transform

THE ELEMENTARY APPROACH to calculating a Fourier transform using numerical methods is expressed for the discrete sample as:

$$F(r) = \sum_{n=0}^{N-1} f(n).e^{\frac{nw^2n}{r}}$$

where r is 0,1,2,...N – 1.

For each of the N samples of F there are N complex multiply-and-add operations required, and the elementary method requires N^2 operations, writes R G Ranson of Sunderland, Tyne and Wear. The alternative approach called the fast Fourier transform reduces this to $N\log_2 N$ operations simply by rearranging the order of the calculations.

The FFT involves no approximations other than those inherent in the discrete, long-hand method and so the two methods yield exactly the same answer. The only difference is that for large numbers of samples the FFT offers significant improvements in computational speed. For example, if N is equal to 1,024 the FFT involves 10,240 operations, compared to 1,048,576 using the elementary approach.

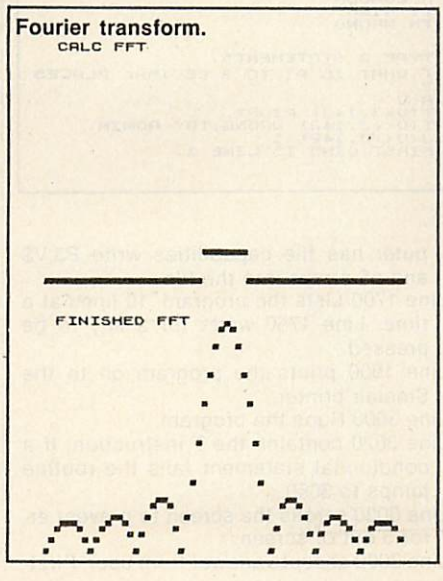
The advantages of the FFT algorithm lie in the redundancy involved in the elementary expression. The complex exponential term is cyclic and has discrete values according to the integer values of n and r. Thus different combinations of n and r give the same result while other combinations simply give a negated result. This property is used by the FFT to pair off what are termed dual nodes in order to save operations. This pairing effectively halves the sample N and can be applied *ad infinitum*, provided the resulting sample is a multiple of 2. This leads to a special case used in this and most FFT algorithms, where the sample number N is a power of 2. The pairing process is applied $\log_2 N$ times to yield a simple one-point transform.

The FFT algorithm by necessity does not perform the summations in the neat fashion of the elementary expression, rather in convenient blocks of values of n and r which give equal exponential terms. This leads to a space-saving advantage employed in this implementation. The elementary approach needs all values of f(n) to sum for each F(r) and so two arrays need to be declared, one for input and one for output. The dual-node approach calculates certain combinations of r and n simultaneously and so enables the input array to be gradually overwritten with the transformed solution. The only disadvantage in this is that some answers end up in the wrong place and so an additional decoding routine is needed to swap values about before finishing. However, this is a small price to pay compared to the space saving; a 1,024 array of real and imaginary parts on a ZX-81 occupies 10K of memory.

The program is a ZX-81 Basic implementation of the Cooley and Tuckey, fast Fourier transfer algorithm. For illustration it uses a unit impulse time function as the input signal, and having transformed it plots the magnitude of the resulting function. This can be solved analytically and shown to the (sin x)/x function displayed at the end. Typical computation time is 48 seconds for the 64-point example in Fast mode, which includes the initialisation and plotting. Alterations to the sample number N show a roughly linear dependence of computation time with N, confirming the FFT properties; the elementary method would result in an exponential dependence.

A final application note may be useful regarding scaling as it is rarely covered in numerical analysis references. The input and output functions have one sample per array element and thus have no time or frequency dimensions. However, this does not affect the transform as it is linear. So the algorithm assumes time samples one second apart and frequency samples one radian/second apart. For other values linear scaling applies: time samples 1ms. give frequency samples 2π kHz apart, and so on. The transform is also bidirectional so that time signals may be transformed to frequency or vice versa.

Fourier transform.



Fourier transform.

```
  1 REM *** FFT  ALGORITHM ***
  2 REM
  3 REM DR R.G.RANSON  22/5/82
  4 REM
  5 REM SAMPLE NUMBER N MUST
  6 REM BE A POWER OF TWO
  7 REM
 10 LET L=6
 13 LET N=2**L
 15 DIM X(N)
 16 DIM Y(N)
 20 PRINT AT 1,1;"CALC FFT"
 25 REM TEST USING A SINGLE
 26 REM RECTANGULAR PULSE
 30 FOR I=1 TO 4
 40 LET X(I)=1
 50 LET X(N-I+1)=1
 60 NEXT I
 70 GOSUB 2000
195 REM ************************
197 REM  FAST FOURIER TRASFORM
198 REM ************************
199 REM INITIAISE VAIABLES
200 LET M=N/2
210 LET R=2**(L-1)
220 LET H=1
230 LET A=(PI+PI)/N
240 FOR P=1 TO L
250 LET B=INT  ((H-1)/R)
260 GOSUB 1000
270 LET B=A*B
280 LET I=SIN B
290 LET J=COS B
295 FOR Q=1 TO M
300 LET K=H+M
310 LET C=X(K)*J+Y(K)*I
320 LET D=Y(K)*J-X(K)*I
330 LET X(K)=X(H)-C
340 LET Y(K)=Y(H)-D
350 LET X(H)=X(H)+C
360 LET Y(H)=Y(H)+D
400 LET H=H+1
410 NEXT Q
420 LET H=H+M
430 IF H<=N THEN GOTO 250
440 LET H=1
450 LET R=R/2
460 LET M=M/2
470 NEXT P
480 CLS
499 PRINT AT 1,1;"DECODE FFT"
500 REM DECODE FFT ARRAY
510 FOR P=1 TO N
520 LET B=P-1
530 GOSUB 1000
540 LET H=B+1
550 IF H<P THEN GOTO 620
555 REM SWAP VALUES
560 LET C=X(P)
570 LET D=Y(P)
580 LET X(P)=X(H)
590 LET Y(P)=Y(H)
600 LET X(H)=C
610 LET Y(H)=D
620 NEXT P
630 PRINT AT 1,1;"FINISHED FFT"
640 REM CALC MAGNITUDE
650 REM SHOULD BE (SIN X)/X
700 FOR I=1 TO N
710 LET X(I)=SQR (X(I)*X(I)+Y(I
)*Y(I))
720 NEXT I
800 GOSUB 2000
990 CLEAR
995 STOP
998 CLEAR
999 REM BIT REVERSAL ROUTINE
1000 LET K=0
1010 FOR I=1 TO L
1020 LET J=INT (B/2)
1030 LET K=B+INT (K+K-J-J)
1040 LET B=J
1050 NEXT I
1060 LET B=K
1070 RETURN
1999 REM PLOT ROUTINE
2000 LET D=N/2
2010 LET C=INT (N+1)/2
2020 FOR I=1 TO N
2030 PLOT I-1-SGN (I-C)*D,X(I)*5
2040 NEXT I
2050 REM COPY
2060 RETURN
```

Pilot interpreter

PILOT was designed at the San Francisco Medical Centre in 1973 as a language for use in Computer-aided instruction. CAI depends, to some extent, on forming a dialogue with the user, and Pilot is one of the "author languages" which produce programs for conducting a question-and-answer session with the user.

Pilot is very simple to use, without the complicated constructions of Basic and other high-level languages. The listing is of a Pilot interpreter for the ZX-81 by Andrew Esmond of Scarborough, North Yorkshire. It is written in Basic and uses mainly standard instructions.

A Pilot program consists of program lines, similar to those in Basic though line numbers are not used. The program executes from the first line: conditional statements and conditional and unconditional jumps are allowed. The following are the main Pilot commands.

Run — This command runs the program from the first line.

List — This lists the program in groups of 10 lines. When 10 lines have been listed the program waits for the user to press a

(continued on next page)

(continued from previous page)

key before continuing. The line numbers displayed at the side of the lines are not part of the program, and are there only to help editing — see notes on editing.

LList — This lists the program to the Sinclair printer. The line numbers are not printed.

New — This is identical to New in Basic.

Save — This saves the program on to tape. Since the ZX-81 does not support files the entire interpreter program is saved.

Load — This loads a Pilot program into the computer.

The following are the main Pilot statements:

T: — Short for Type, prints the text following the colon. Both types of conditional statements are allowed.

A: plus optional variable — A is short for Answer; any string or floating-point number may be accepted. On the ZX-81 answers such as Log 3.141 can be accepted.

M — short for Match, M: compares the last user input with the data following the colon in the M statement. If the answer matches, the Answer flag is set to 1, otherwise it is set to −1.

J: plus statement number — J is short for Jump, and the program jumps to the line mentioned. Type 1 and 2 conditional statements are allowed. If the program attempts to jump beyond the end of the program a Jump-out-of-range error occurs.

Two editing statements are allowed, the I and R statements. I is short for Insert, and inserts a line at the required point; all subsquent lines are then moved up by one. R is short for Replace, and the specified line is replaced. Pilot allows 26 floating-point variables, A to Z, and 26 string variables of up to 32 characters. Variables may only be assigned through the A statement, but may be used in type 2 conditional statements.

Type 1 conditional statements use the result of the latest M statement and are in the following form.

TY RIGHT — Types "RIGHT" if the result of the last match is true.

TN WRONG — Types "WRONG" if the result of the last match is false.

Y or N replaces the colon in the type statement. Y and N may only be used in T and J statements.

Type two conditional statements are similar to Basic's If-Then. It has the following form:

T(X = 3) X is equal to three — types string if x = 3.

J(SGN X = 1) 4 — jumps to line 4 if X is positive.

Figure 1 includes some examples of Type 1 and Type 2 conditional statements.

The main features of the interpreter program are as follows:

Line 10. Is not a two-dimensional string array but 100 strings each 32 chrs long. This array holds the program

Line 20 holds all floating-point variables.

Line 30 holds all string variables.

In Line 1000 all the spaces are significant. For ZX-81 users all commands except LList must be typed in full.

Line 1300 saves the program. If your computer has file capabilities write P$,V$ and p$ arrays into the file.

Line 1700 Lists the program, 10 lines at a time. Line 1750 waits for a key to be pressed.

Line 1900 prints the program on to the Sinclair printer.

Line 3000 Runs the program.

Line 3020 contains the T instruction. If a conditional statement fails the routine jumps to 3050.

Line 3030 scrolls the screen to prevent error 5 out of screen.

Line 3060 accepts answer from user. Firstly it is held in t$, then transferred into the variable required, if specified.

Line 3340 contains the match command. If the match succeeds the A flag is set to 1, else it equals −1.

Line 3340 contains the match command. If the match succeeds the A flag is set to 1, else it equals −1.

Line 3400 contains the J command. If a type 2 conditional statement is included the jump occurs only if the result is true.

Line 8000 is the only machine-specific subroutine. It works out the result of a type 2 conditional statement, returning the result in variable VA. The start and end of the condition are established and put into J$. Any variables are replaced by their values. The Val statement on a ZX-81 will evaluate any mathematical expression in a string, and is equivalent to Eval$ on the BBC Micro and is also available on the TI-99/4A

Line 9000 checks for valid input and adds it to the program. Your commands may be added by altering line 9050. Lines 9800 onwards are the editing sections.

Pilot interpreter.

```
FIGURE 1;PILOT INTERPRETER.

   2 LET VA=1
  10 DIM P$(100,2
  11 LET MM=100
  20 DIM V(26)
  30 DIM V$(26,32)
  40 LET PC=1
  50 LET SP=1
  60 LET VP=1
  70 CLS
  80 PRINT "        PILOT V2.1"
  90 PRINT " (C) A.ESMOND 1982"
  95 PRINT MM;" LINES FREE."
 100 GOTO 9000
1000 REM ***CMD ROUTINE***
1001 SLOW
1010 IF I$="NEW " THEN RUN
1020 IF I$="SAVE " THEN GOTO 130
0
1030 IF I$="LOAD " THEN GOSUB 15
00
1040 IF I$="LIST " THEN GOSUB 17
00
1050 IF I$=" LLIST  " THEN GOSUB
1900
1060 IF I$="RUN " THEN GOSUB 300
0
1070 GOTO 9020
1300 CLS
1310 PRINT "WHEN THE TAPE HAS BE
EN STARTED  PRESS (N/L)"
1320 INPUT L$
1330 SAVE "PILOT"
1340 GOTO 9020
1500 CLS
1510 PRINT "WHEN THE TAPE HAS BE
EN STARTED  PRESS (N/L)"
1520 INPUT L$
1530 LOAD ""
1540 RETURN
1700 CLS
1710 FOR F=1 TO PC-1
1715 CLS
1720 PRINT F;")";P$(F)
1730 IF F/10=INT (F/10) THEN GOT
O 1750
1740 GOTO 1760
1750 PAUSE 4E4
1760 NEXT F
1765 IF F<20 THEN LET L=F
1770 RETURN
1900 FOR F=1 TO PC
1910 LPRINT P$(F)
1920 NEXT F
1930 RETURN
3000 REM RUN
3001 CLS
3002 LET T$=""
3003 LET A=0
3010 FOR F=1 TO PC
3011 LET PP=3
3020 IF P$(F,1)<>"T" THEN GOTO 3
060
3021 IF P$(F,2)="Y" AND A<>1 THE
N GOTO 3050
3023 IF P$(F,2)="N" AND A<>-1 TH
EN GOTO 3050
3024 IF P$(F,2)="(" THEN GOSUB 8
000
3025 IF P$(F,2)="(" AND NOT VA T
HEN GOTO 3800
3027 IF P$(F,2)<>"(" THEN LET PP
=3
3030 IF PEEK 16442=3 THEN SCROLL

3040 PRINT P$(F,PP TO )
3050 NEXT F
3055 RETURN
3060 IF P$(F,1)<>"A" THEN GOTO 3
340
3065 INPUT T$
3070 FAST
3080 IF P$(F,1)<>"A" THEN GOTO 3
340
3090 IF P$(F,4)="$" THEN GOTO 33
00
3100 IF P$(F,3)<>" " THEN GOTO 3
320
3200 LET J=CODE P$(F,3)-37
3210 IF P$(F,3)=" " THEN GOTO 33
40
3215 LET V(J)=VAL T$
3220 NEXT F
3230 RETURN
3300 LET J=CODE P$(F,3)-37
3310 LET V$(J)=T$
3320 NEXT F
3330 RETURN
3340 IF P$(F,1)<>"M" THEN GOTO 3
410
3350 LET M$=P$(F,3 TO )
3360 LET A=-1
3380 IF T$=M$( TO LEN T$) THEN L
ET A=1
3390 NEXT F
3400 RETURN
3410 IF P$(F,1)<>"J" THEN GOTO 3
390
3411 IF P$(F,2)="Y" AND A<>1 THE
N GOTO 3800
3413 IF P$(F,2)="N" AND A<>-1 TH
EN GOTO 3800
3414 IF P$(F,2)="(" THEN GOSUB 8
000
3415 LET PP=3
3420 LET JP=VAL P$(F,PP TO )
3430 LET F=JP-1
3435 IF (F>MM) OR (F>PC) THEN GO
TO 4000
3440 NEXT F
3450 RETURN
3800 NEXT F
3810 RETURN
4000 LET F=PC
4010 PRINT AT 21,0;"JUMP AT ";F;
" OUT OF RANGE."
4020 RETURN
8000 REM EVAL CMD
8001 FAST
8010 LET PP=3
8020 IF P$(F,PP)=")" THEN GOTO 8
100
8030 LET PP=PP+1
8031 IF PP=33 THEN RETURN
8040 GOTO 8020
8100 LET J$=P$(F,3 TO PP)
8110 FOR G=1 TO LEN J$
8120 IF J$(G)>="A" AND J$(G)<="Z
" THEN LET J$=J$(1 TO G-1)+STR$
V(CODE J$(G)-37)+J$(G+1 TO )
8130 LET VA=VAL J$( TO LEN J$-1)
8131 SLOW
8132 LET PP=PP+2
8140 RETURN
9000 REM CMD INP
9001 LET RE=0
9002 SLOW
9010 LET L=1
9020 INPUT I$
9021 IF I$="" THEN GOTO 9020
9022 LET I$=I$+" "
9025 LET RE=0
9025 FAST
9030 IF I$="LOAD " OR I$="SAVE "
 OR I$="RUN " OR I$=" LLIST  " O
R I$="NEW " OR I$="LIST " THEN G
OTO 1000

9031 IF I$(1)="R" OR I$(1)="I" T
HEN GOTO 9900
9040 LET L$=I$(1)
9050 IF (I$(2)="Y" OR I$(2)="N"
OR I$(2)=" " OR I$(2)="(" AND (
L$="T" OR L$="A" OR L$="M" OR L$
="J" OR L$="P") THEN GOTO 9100
9055 IF RE=1 THEN RETURN
9060 PRINT AT 21,0;"ILLEGAL STAT
EMENT."
9065 SLOW
9070 INPUT I$
9072 IF I$="" THEN GOTO 9070
9074 LET I$=I$+" "
9080 PRINT AT 21,0;"
                    "
9090 GOTO 9030
9100 IF RE=1 THEN RETURN
9101 LET P$(PC)=I$
9105 SLOW
9110 PRINT AT L,0;P$(PC)
9115 LET PC=PC+1
9120 IF L<20 THEN LET L=L+1
9130 IF L=20 THEN SCROLL
9140 GOTO 9020
9800 FOR G=MM-1 TO L STEP -1
9810 LET P$(G)=P$(G-1)
9820 NEXT G
9825 LET P$(L)=I$
9827 LET PC=PC+1
9830 GOTO 9020
9900 LET RE=1
9910 LET T=PC
9920 LET L=VAL I$(2 TO )
9940 LET J$=I$
9950 INPUT I$
9960 LET I$=I$+" "
9970 GOSUB 9030
9975 IF J$(1)="I" THEN GOTO 9800
9980 LET P$(L)=I$
9990 GOTO 9020
```

Pilot interpreter.

```
FIGURE 4.CONDITIONAL STATEMENTS.
TYPE 1,Y OR N STATEMENTS.

T:WHAT IS THE CAPITAL OF ENGLAND
?
A:
M:LONDON
TY RIGHT
TN WRONG

TYPE 2 STATEMENTS.
T:WHAT IS PI TO 3 DECIMAL PLACES
?
A:V
T(V=3.142) RIGHT.
T(V<>3.142) WRONG,TRY AGAIN.
J(V<>3.142) 1
FIRST LINE IS LINE 1.
```

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● Circle No. 209

Learn morse

THE PROGRAM by L G Sear from Truro, Cornwall, generates random five-digit groups of letters, figures, or a mixture of the two, and outputs them as morse code through the internal speaker at speeds from four to 24 words per minute. It is thus suitable for the raw beginner to work up to the 12 words per minute requirement of the GPO test for a full amateur radio licence, or for the more experienced operator to improve his or her speed.

The random digits are generated using Basic, and the routine for actually outputting the morse equivalent is in machine code residing from 0300 to 0371.

Lines 10 to 21 carry the machine-code routine Poked in by line 30; lines 22 and 23 contain the constants for the output speeds. There are two speed ranges: four to 14, and 15 to 24 words per minutes, with the digits being sent at the maximum of the appropriate range and the actual word rate being achieved by altering the times between the digits and groups.

Lines 112 to 118 request and input the desired speed, and alter the appropriate constants; for speeds greater than 14 words per minute three locations in the machine-code routine must be altered.

The remainder of the program is straightforward enough, using the functions outlined above to generate ten lines of six five-digit groups of code at the desired speed and to display them simultaneously on the screen. Then the computer pauses ready for another run if required.

Program recovery

BASIC PROGRAMS which have accidentally been Newed can be restored by the program given by Malcolm Whapshott in Apple Pie, November 1981. M J Parrot of Stockport Cheshire points out that an easier method was provided by Nigel Parry in Microsense Apple Bulletin.

It is important that the entire program is entered in the Immemate Execution mode and that after entry you only List your program from top to bottom and then Save it. Press Return after each line of the program.

Apple tree.

```
0 REM: A TREE FOR YOUR APPLE - © DR D.J.FISHER, 1982
1 ONERR GOTO 2
2 A = 2: Y = 0.5: X = 1
3 HGR: HCOLOR = 2
4 HPLOT 100*Y, 150 - X
5 X = X + 0.05
6 A = A + 0.001
7 Y = A*Y*(1 - Y)
8 GOTO 4
```

Apple tree

WHILE CARRYING OUT some part-time search into the theory of chaotic functions. I came across an interesting pattern, writes David Fisher of Cardiff. The amusing thing about it is the fact that the pattern theoretically contains an infinite number of branches although there is no branch at all in the program, apart from line 1, which is superfluous.

The program is written for the Apple II, if you wish to study the resultant pattern in detail you should omit line 1, which was included only for want of a more elegant method of finishing off the program.

Learn morse.

```
1 REM G3PPT MORSE TEST PROGRAM
2 HOME : PRINT SPC(20);"WAIT"
5 DIM SPEED(24)
10 DATA 253,125,61,29,13,5,133,197,229,245
11 DATA 66,132,164,131,1,36,195,4,2,116
12 DATA 163,68,194,130,227,100,212,67,3,129
13 DATA 35,20,99,148,180,196,32,2,173,17
14 DATA 3,141,36,3,41,7,141,37,3,46
15 DATA 36,3,176,5,169,26,76,61,3,169
16 DATA 78,141,92,3,169,192,141,95,3,32
17 DATA 93,3,169,26,141,92,3,169,0,141
18 DATA 95,3,32,93,3,206,37,3,208,215
19 DATA 96,48,7,173,48,192,136,208,5,206
20 DATA 92,3,240,9,202,208,245,174,91,3
21 DATA 76,93,3,96
22 DATA 1050,750,575,450,340,245,175,120,75,25,0
23 DATA 145,120,97,75,58,43,35,16,8,0
25 FOR I = 1 TO 114
30 READ A: POKE 767+I , A :NEXT I
35 FOR I = 4 TO 24 : READ SPEED(I) : NEXT I
37 A = 100
100 DEF FNA(A) = 48 + INT(RND(1)*10) : REM FIGURES GENERATOR
101 DEF FNB(A) = 65 + INT(RND(1)*26) : REM LETTERS GENERATOR
102 DEF FNC(A) = 1 + INT(RND(1)*3) : REM USED FOR LETTER/FIGURE MIXTURES
104 HOME : PRINT "G3PPT MORSE TEST PROGRAM" : PRINT
105 PRINT"DO YOU WANT :-"
106 PRINT TAB(10);"1 LETTERS"
107 PRINT TAB(10);"2 FIGURES"
108 PRINT TAB(10);"3 A MIXTURE" : PRINT
110 INPUT II : IF II > 3 THEN 104
112 PRINT "INPUT SPEED REQUIRED"
113 INPUT"INTEGER BETWEEN 4 AND 24 W.P.M. ? ";I%
114 IF I% < 4 OR I% > 24 THEN 112
115 N = SPEED(I%) : PRINT
116 IF I% < 15 THEN 120
117 REM CHANGE CONSTANTS FOR FASTER SPEED
118 A = 50 : POKE 823,15 : POKE 828,45 : POKE 841,15
120 FOR I = 1 TO 10 : REM 10 LINES
130 FOR J = 1 TO 6 : REM 6 GROUPS/LINE
140 FOR K = 1 TO 5 : REM 5 DIGITS/GROUP
150 ON II  GOTO 160,180,200
160 REM LETTERS
170 L = FN B(1) : GOTO 220
180 REM FIGURES
190 L = FN A(1) : GOTO 220
200 REM MIXED LETTERS/FIGURES
210 LL = FN C(1): ON LL GOTO 170,170,190: REM FOR LETTERS/FIGURES IN 2:1 RATIO
220 PRINT CHR$(L);
221 IF L < 58 THEN L = L-48
222 IF L > 64 THEN L = L-55
225 POKE 807,L : REM PASS CHARACTER TO SUBROUTINE
226 CALL 806 : REM O/P MORSE CHARACTER
227 FOR M = 1 TO A + N : NEXT M : REM DELAY BETWEEN CHARACTERS
230 NEXT K
235 FOR M = 1 TO 3*A +3*N : NEXT M : REM DELAY BETWEEN GROUPS
240 PRINT " ";
250 NEXT J
260 PRINT CHR$(13)
270 NEXT I
280 PRINT "PRESS ANY KEY TO CONTINUE"
290 GET A$ : IF A$ = "" THEN 290
300 RUN
```

Program recovery.

```
LOMEM:38200     (assuming a 48K system)
X=PEEK(103) + PEEK(104)*256: Z=X+5
FOR A = Z TO Z+275: IF PEEK(A)<>0 THEN NEXT
A=A+1: HI =INT(A/256): LO =A-HI*256
POKE X,LO: POKE X+1,HI
```

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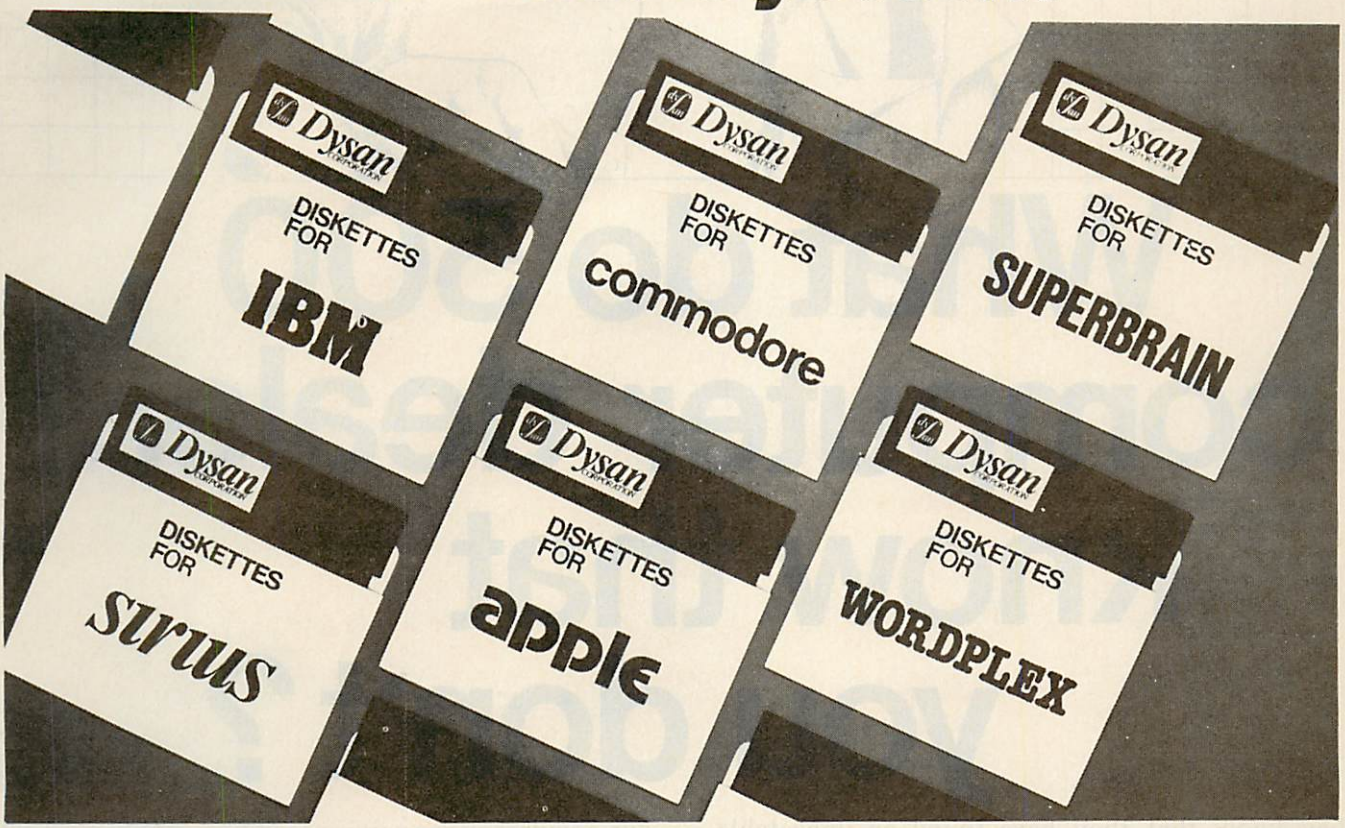

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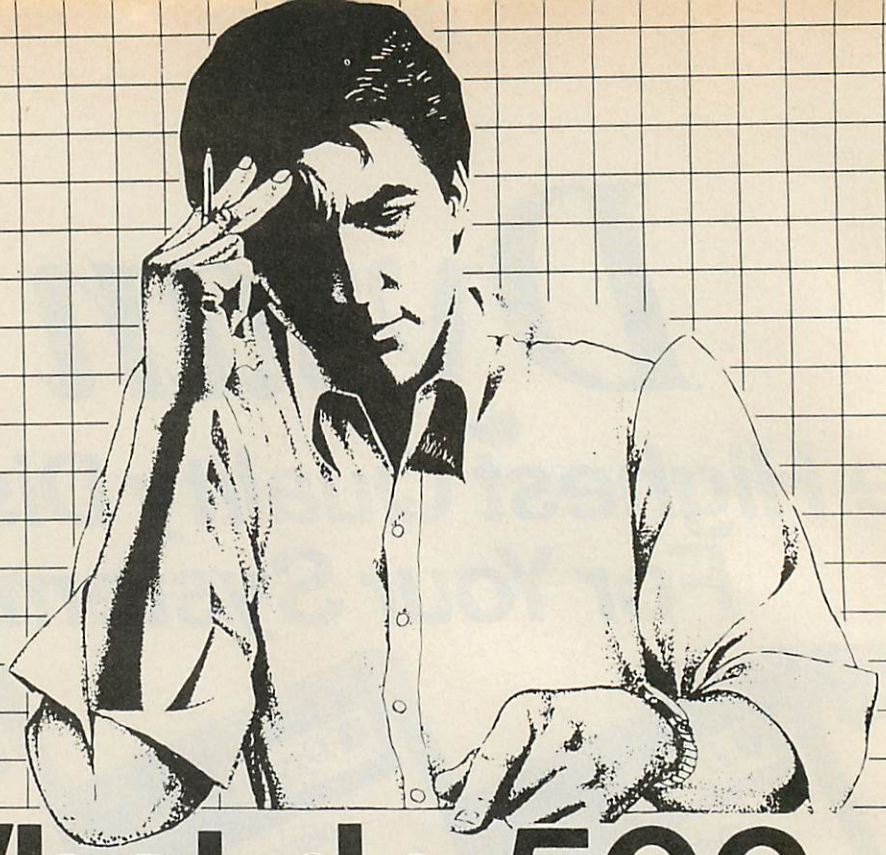

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● Circle No. 211

Programming utilities.

```
SOURCE FILE: AMP GOTO/GOSUB
----- NEXT OBJECT FILE NAME IS AMP GOTO/GOSUB.OBJ0
0300:             1          ORG  $300
03F6:             2 AMPVEC   EQU  $3F6
004C:             3 JMP      EQU  $4C
DEC9:             4 SYNTAXERR EQU $DEC9
00B1:             5 CHRGET   EQU  $B1
DD67:             6 FRMNUM   EQU  $DD67
E752:             7 GETADR   EQU  $E752
00B8:             8 TXTPTR   EQU  $B8
D941:             9 GOTO     EQU  $D941
0075:            10 CURLIN   EQU  $75
D7D2:            11 NEWSTT   EQU  $D7D2
D3D6:            12 NESTCHK  EQU  $D3D6
0300:            13 ;
0300:            14 ;SET UP & VECTOR TO POINT TO ROUTINE
0300:            15 ;
0300:A9 4C       16          LDA  #JMP
0302:8D F5 03    17          STA  AMPVEC-1
0305:A9 10       18          LDA  #>START
0307:8D F6 03    19          STA  AMPVEC
030A:A9 03       20          LDA  #<START
030C:8D F7 03    21          STA  AMPVEC+1
030F:60          22          RTS
0310:            23 ;
0310:            24 ;COME HERE FROM APPLESOFT &
0310:            25 ;
0310:A0 00       26 START    LDY  #00
0312:A9 AB       27          LDA  #$AB ;TOKEN FOR GOTO
0314:D1 B8       28          CMP  (TXTPTR),Y ;IS NEXT TOKEN IN LINE "GOTO"
0316:F0 09       29          BEQ  NEWGOTO ;YES
0318:A9 B0       30          LDA  #$B0 ;TOKEN FOR GOSUB
031A:D1 B8       31          CMP  (TXTPTR),Y ;IS TOKEN "GOSUB"?
031C:F0 0F       32          BEQ  NEWGOSUB ;YES
031E:4C C9 DE    33          JMP  SYNTAXERR ;IF NEITHER THEN EXIT VIA SYNTAX ERRO
R
0321:            34 ;
0321:            35 ;NEWGOTO UPDATES TEXTPTR TO POINT TO
0321:            36 ;FIRST CHAR OF EXPRESSION,
0321:            37 ;EVALUATES THE EXPRESSION,
0321:            38 ;CONVERTS IT TO INTEGER FORMAT
0321:            39 ;FOR NORMAL GOTO CODE AND EXITS
0321:            40 ;INTO APPLESOFT GOTO CODE
0321:            41 ;
0321:20 B1 00    42 NEWGOTO  JSR  CHRGET ;POINT AT EXPR.
0324:20 67 DD    43          JSR  FRMNUM ;CALCULATE EXPR.
0327:20 52 E7    44          JSR  GETADR ;CONVERT TO INTEGER
032A:4C 41 D9    45          JMP  GOTO
032D:            46 ;
032D:            47 ;NEWGOSUB MUST PUSH RETURN ADDRESS
032D:            48 ;AND RETURN LINE NUMBER AND PUSH
032D:            49 ;TOKEN FOR GOSUB FOR "RETURN WITHOUT
032D:            50 ;GOSUB" CHECK.
032D:            51 ;HAVING FOUND THE NEW LINE NUMBER
032D:            52 ;IT USES GOTO AS A SUBROUTINE TO
032D:            53 ;LOCATE THE NEXT LINE IN THE
032D:            54 ;PROGRAM,AND THEN EXITS VIA
032D:            55 ;APPLESOFT CONTINUE
032D:            56 ;
032D:A9 03       57 NEWGOSUB LDA  #3
032F:20 D6 D3    58          JSR  NESTCHK ;CHECK LEVEL OF NESTING OK-EXIT VIA OUT
 OF MEM. IF NESTING TOO DEEP
0332:20 B1 00    59          JSR  CHRGET
0335:A5 B9       60          LDA  TAIFTRI+
0337:48          61          PHA ;HI-BYTE RETURN ADDRESS
0338:A5 B8       62          LDA  TXTPTR
033A:48          63          PHA ;LO-BYTE RETURN ADDRESS
033B:A5 76       64          LDA  CURLIN+1
033D:48          65          PHA ;HI-BYTE RETURN LINE NO.
033E:A5 75       66          LDA  CURLIN
0340:48          67          PHA ;LO-BYTE RETURN LINE NO.
0341:A9 B0       68          LDA  #$B0 ;"GOSUB" TOKEN
0343:48          69          PHA
0344:20 67 DD    70          JSR  FRMNUM
0347:20 52 E7    71          JSR  GETADR
034A:20 41 D9    72          JSR  GOTO
034D:4C D2 D7    73          JMP  NEWSTT
```

```
0300- A9 4C 8D F5 03 A9 10 8D
0308- F6 03 A9 03 8D F7 03 60
0310- A0 00 A9 AB D1 B8 F0 09
0318- A9 B0 D1 B8 F0 0F 4C C9
0320- DE 20 B1 00 20 67 DD 20
0328- 52 E7 4C 41 D9 A9 03 20
0330- D6 D3 20 B1 00 A5 B9 48
0338- A5 B8 48 A5 76 48 A5 75
0340- 48 A9 B0 48 20 67 DD 20
0348- 52 E7 20 41 D9 4C D2 D7
*
```

8ON

```
SOURCE FILE: IMMEDIATE COMMANDS
----- NEXT OBJECT FILE NAME IS IMMEDIATE COMMANDS.OBJO
0300:             1          ORG  $300
004C:             2 JMP      EQU  $4C
03F5:             3 AMPVEC   EQU  $3F5
00B0:             4 GOSUB    EQU  $B0
00B8:             5 TEXTPTR  EQU  $B8
0075:             6 CURRLIN  EQU  $75
ED19:             7 INPRT    EQU  $ED19
D3D6:             8 NESTCHK  EQU  $D3D6
D43C:             9 BASIC    EQU  $D43C
FDF0:            10 COUT     EQU  $FDF0
0300:            11 ;
0300:            12 ;SET & JUMP VECTOR
0300:            13 ;
0300:A9 4C       14 INIT     LDA  #JMP
0302:8D F5 03    15          STA  AMPVEC
0305:A9 10       16          LDA  #>ENTRY
0307:8D F6 03    17          STA  AMPVEC+1
030A:A9 03       18          LDA  #<ENTRY
030C:8D F7 03    19          STA  AMPVEC+2
030F:60          20          RTS
0310:            21 ;
0310:            22 ;COME HERE FROM BASIC "&"
0310:            23 ;
0310:A2 06       24 ENTRY    LDX  #6
0312:BD 35 03    25 LOOP     LDA  MESSAGE,X
0315:20 F0 FD    26          JSR  COUT
0318:CA          27          DEX
0319:10 F7       28          BPL  LOOP ;PRINT "PAUSED"
031B:20 19 ED    29          JSR  INPRT ;"IN" LINE NUMBER
031E:A9 03       30          LDA  #3
0320:20 D6 D3    31          JSR  NESTCHK ;CHECK NESTING LEVEL-MAX. NESTING=25
0323:A5 B9       32          LDA  TEXTPTR+1
0325:48          33          PHA
0326:A5 B8       34          LDA  TEXTPTR
0328:48          35          PHA ;PUSH RETURN ADDRESS
0329:A5 76       36          LDA  CURRLIN+1
032B:48          37          PHA
032C:A5 75       38          LDA  CURRLIN
032E:48          39          PHA ;PUSH RETURN LINE NO.
032F:A9 B0       40          LDA  #GOSUB
0331:48          41          PHA ;PUSH "GOSUB" TOKEN FOR "RETURN WITHOUT GOSUB" C
HECK
0332:4C 3C D4    42          JMP  BASIC ;EXECUTE IMM. COMMAND BY RETURNING TO BAS
IC
0335:C4 C5 D3    43 MESSAGE  ASC  "DESUAP" ;"PAUSED" BACKWARDS
0338:D5 C1 D0
033B:8D          44          DFB  $8D ;CARRIAGE RETURN
```

```
*** SUCCESSFUL ASSEMBLY: NO ERRORS
0300- A9 4C 8D F5 03 A9 10 8D
0308- F6 03 A9 03 8D F7 03 60
0310- A2 06 BD 35 03 20 F0 FD
0318- CA 10 F7 20 19 ED A9 03
0320- 20 D6 D3 A5 B9 48 A5 B8
0328- 48 A5 76 48 A5 75 48 A9
0330- B0 48 4C 3C D4 C4 C5 D3
0338- D5 C1 D0 8D
*
```

Programming utilities

TWO MACHINE-CODE routines for the Apple II have been written by C Dorsman of Liverpool. The first is an extension to the Applesoft Goto and Gosub commands, which allows the arguments of these commands, the destination line numbers, to be expressions of any complexity which can include variables. The second is a short routine which allows the execution of immediate commands from the keyboard at any time while an Applesoft program is running.

Both routines are linked to Basic via Applesoft's & command, which causes a jump to location #3F5 in memory, from where control is passed to the routine. You can either assemble the sources as shown — I used Apple's Dos Toolkit assembler — or key in the hex listings directly from the monitor.

Ampersand Goto/Gosub should be saved using

BSAVE AMP GOTO/GOSUB, A #300,L #50

or

*300.34FW

to save on tape.

The routine is linked to Basic by BRunning Amp Goto/Gosub, or after BLoading, Call 768 or 300G from the monitor. The code can be relocated without change as long as the & vector points to the beginning of the routine. The syntax of the new Goto/Gosub construction is:

& Goto expression
& Gosub expression

Run the following programs to see the routines working:

```
10 INPUT "ENTER LINE NUMBER (1-3)
   ";N
20 & GOTO N*100+5
105 PRINT.PRINT"THIS IS LINE 105":
   GOTO 10
205 PRINT:PRINT"THIS IS LINE 205":
   GOTO 10
305 PRINT:PRINT"THIS IS LINE 305":
   GOTO 10
```

```
10 INPUT"ENTER LINE NUMBER (1-3)
   ";N 20 & GOSUB N*100+5
30 GOTO 10
105 PRINT:PRINT"THIS IS LINE 105":
   RETURN
205 PRINT:PRINT"THIS IS LINE 205":
   RETURN
305 PRINT:PRINT"THIS IS LINE 305":
   RETURN
```

Of course, the usual Goto line number and Gosub line number can still be used while Amp Goto/Gosub is in operation. The working of the routine is explained in the listing.

The Immediate Commands program should be saved using

BSAVE IMMEDIATE COMMANDS
A # 300,L # 3C

or

*300.33BW

to save on tape.

The routine is again linked to Basic by BRuning Immediate Commands, or after BLoading, Call 768 or 300G from the monitor. The code can again be relocated so long as the address of Message in line 25 is adjusted appropriately.

When & is encountered in a program

(continued on next page)

(continued from previous page)

control is passed to the routine which first prints "paused in" followed by the current line number. Next, the stack is set up as if a Basic Gosub had been encountered. The return address is pushed followed by the return line number and the token for Gosub — used for Return-Without-Gosub check. Instead of branching to a subroutine, control is passed back to Basic Immediate mode by exiting through #D43C.

Any command may now be entered from the keyboard until the Basic Return is entered, at which time control will pass back to the stored program at the statement directly following the & where the program was interrupted, and the program will continue running as if it had never been stopped.

The & command could now be inserted in several places in a program and used as a very flexible debugging aid. Run the following program to show how easy it is to use:

```
10 FOR I = 1 TO 10000
20 PRINT I*I? SQR (I)
30 K = PEEK ( – 16384) : IF K = 137
THEN POKE – 16368,0 : &
40 NEXT
```

Line 30 tests if a Control-I has been pressed, and if so control is passed to Basic. You may now type in commands such as Print I, Print K, etc.

Type

```
I = 1000 : RETURN
```

followed by carriage return to show that even the value of the loop counter may be changed if desired. Of course, you do not have to return to the controlling program but may continue in Basic. In this case it is wise to tidy the stack by using the command Pop from the keyboard. This will clear the return address from the stack causing a Return-without-Gosub error if a Return is now attempted. If, however, the & is encountered within a subroutine and Return is executed after a Pop, then control will pass back to the program at the statement following the Gosub to the subroutine where the & was found.

Multiple ampersand

AMPER WILL CONTROL the execution of up to 10 programs that use the ampersand & command according to Malcolm Whapshott of Farnham, Surrey. The program should be loaded either first or second, than a call made to Amper, then subsequent programs should be loaded and Amper should be called after each.

To call a particular routine, type & then type the number of the routine, numbered from 0 to 9 depending on the order in which the programs were loaded, zero first. Then type a comma then any information the program might need.

An example is, if the Applesoft programmer's aid was the second program loaded after Amper and you wanted to use the auto line numbering. The command would look like:

```
& 1,AUTO 10,10
```

Multiple ampersand.

```
SOURCE FILE: AMP
0000:                1 **********************
0000:                2 *
0000:                3 * MULTIPLE AMPERSAND
0000:                4 *
0000:                5 * COMMAND HANDLING
0000:                6 *
0000:                7 * ROUTINE
0000:                8 *
0000:                9 *       BY
0000:               10 *
0000:               11 * MALCOLM WHAPSHOTT
0000:               12 *
0000:               13 * (C) COPYRIGHT 1982
0000:               14 *
0000:               15 **********************
0000:               16          MSB  OFF
00B1:               17 CHRGET   EQU  $B1        ;APPLESOFT GET A CHARACTER
03F6:               18 AMPERSAND EQU $03F6      ;& VECTOR LOCATION IN PAGE 3
F948:               19 PRBLNK   EQU  $F948      ;PRINT 3 SPACES
FBE2:               20 FBELL    EQU  $FBE2      ;BEEPS SPEAKER (CTRL G)
FF2D:               21 PRERR    EQU  $FF2D      ;PRINTS ERR
0000:               22          REL
----- NEXT OBJECT FILE NAME IS AMPER
9583:               23          ORG  $9583
9583:A2 00          24 CREATE   LDX  #$00       ;INITIALISE
9585:BD C2 95       25 LOOP     LDA  TABLE+$01,X ;SEARCH TABLE
9588:C9 FF          26          CMP  #$FF       ;FOR FREE LOCATION
958A:D0 26          27          BNE  INCR       ;NO MATCH
958C:BD C1 95       28          LDA  TABLE,X
958F:C9 57          29          CMP  #$57       ;NO MATCH
9591:D0 1F          30          BNE  INCR
9593:AD F7 03       31          LDA  AMPERSAND+$01 ;MATCH FOUND
9596:9D C2 95       32          STA  TABLE+$01,X ;SO MOVE VECTOR
9599:AD F6 03       33          LDA  AMPERSAND ;TO TABLE
959C:9D C1 95       34          STA  TABLE,X
959F:D0 03          35          BNE  RTN        ;DECREASE VECTOR
95A1:DE C2 95       36          DEC  TABLE+$01,X ;BY ONE FOR
95A4:DE C1 95       37 RTN      DEC  TABLE,X    ;RTS USED AS JUMP
95A7:A9 D5          38          LDA  #>START    ;REPLACE
95A9:8D F6 03       39          STA  AMPERSAND ;WITH POINTER
95AC:A9 95          40          LDA  #<START    ;TO THIS PROGRAM
95AE:8D F7 03       41          STA  AMPERSAND+$01
95B1:60             42          RTS             ;RETURN TO APPLESOFT
95B2:               43 *-----------------------
95B2:E8             44 INCR     INX             ;INCREASE POINTER
95B3:E8             45          INX             ;BY TWO FOR NEXT ENTRY
95B4:E0 11          46          CPX  #$11       ;END OF TABLE?
95B6:B0 03          47          BCS  FULL       ;IF SO INDICATE IT
95B8:4C 85 95       48          JMP  LOOP       ;CHECK NEXT ENTRY
95BB:               49 *-----------------------
95BB:20 E2 FB       50 FULL     JSR  FBELL      ;BEEP SPEAKER
95BE:4C E2 FB       51          JMP  FBELL      ;BEEP SPEAKER & RETURN TO APPLESOFT
95C1:               52 *-----------------------
95C1:               53 *DEFAULT VALUE OF AMPERSAND JUMP IS $FF58
95C1:               54 *-----------------------
95C1:57 FF          55 TABLE    DW   $FF57      ;ZERO
95C3:57 FF          56          DW   $FF57      ;ONE
95C5:57 FF          57          DW   $FF57      ;TWO
95C7:57 FF          58          DW   $FF57      ;THREE
95C9:57 FF          59          DW   $FF57      ;FOUR
95CB:57 FF          60          DW   $FF57      ;FIVE
95CD:57 FF          61          DW   $FF57      ;SIX
95CF:57 FF          62          DW   $FF57      ;SEVEN
95D1:57 FF          63          DW   $FF57      ;EIGHT
95D3:57 FF          64          DW   $FF57      ;NINE
95D5:               65 *-----------------------
95D5:C9 30          66 START    CMP  #'0        ;IS IT LESS THAN ZERO?
95D7:30 1B          67          BMI  ERR        ;YES, SO INDICATE IT
95D9:C9 3A          68          CMP  #':        ;IS IT GREATER THAN 9?
95DB:B0 17          69          BCS  ERR        ;YES SO INDICATE IT
95DD:38             70          SEC             ;SET UP FOR SUBTRACT
95DE:E9 30          71          SBC  #'0
95E0:0A             72          ASL  A          ;DOUBLE
95E1:AA             73          TAX             ;TRANSFER TO X FOR INDEX
95E2:BD C2 95       74          LDA  TABLE+$01,X ;TO TABLE
95E5:48             75          PHA             ;TO PUSH  CORRECT
95E6:BD C1 95       76          LDA  TABLE,X    ;JUMP ADDRESS
95E9:48             77          PHA             ;ONTO STACK
95EA:20 B1 00       78          JSR  CHRGET     ;GET ANOTHER CHARACTER
95ED:C9 2C          79          CMP  #',        ;IS IT A COMMA?
95EF:D0 03          80          BNE  ERR        ;IF NOT
95F1:4C B1 00       81          JMP  CHRGET     ;JUMP TO ROUTINE VIA CHRGET
95F4:               82 *-----------------------
95F4:68             83 ERR      PLA             ;PULL ADDRESS OF ROUTINE
95F5:68             84          PLA             ;OFF STACK
95F6:20 48 F9       85          JSR  PRBLNK     ;PRINT ERROR MESSAGE
95F9:20 2D FF       86          JSR  PRERR
95FC:4C E2 FB       87          JMP  FBELL      ;BEEP SPEAKER AND RETURN

*** SUCCESSFUL ASSEMBLY: NO ERRORS

 03F6 AMPERSAND        B1 CHRGET        ?9583 CREATE          95F4 ERR
 FBE2 FBELL         95BB FULL            95B2 INCR          9585 LOOP
 F948 PRBLNK        FF2D PRERR           95A4 RTN           95D5 START
 95C1 TABLE
   B1 CHRGET        03F6 AMPERSAND    ?9583 CREATE          9585 LOOP
 95A4 RTN           95B2 INCR            95BB FULL          95C1 TABLE
 95D5 START         95F4 ERR             F948 PRBLNK        FBE2 FBELL
 FF2D PRERR
```

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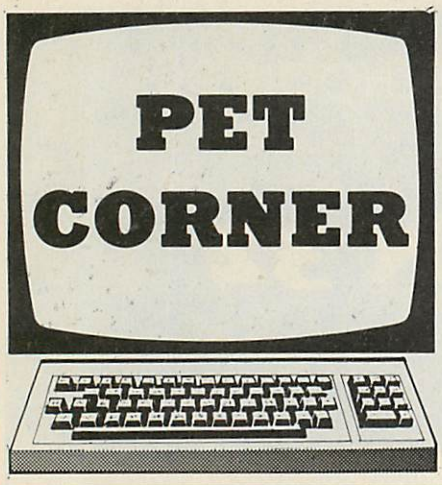

Calendar routine.

```
5 PRINT"■■■■■■■■■■"
10 D$(0)="SATURDAY":D$(1)="SUNDAY"
20 D$(2)="MONDAY":D$(3)="TUESDAY"
30 D$(4)="WEDNESDAY":D$(5)="THURSDAY"
40 D$(6)="FRIDAY"
50 PRINT"TYPE IN THE DATE REQUIRED IN"
60 PRINT"THE ORDER DAY,MONTH,YEAR."
70 PRINT"(THE YEAR MUST BE GIVEN IN FULL)"
75 PRINT:PRINT
80 INPUT D,M,Y
90 IF M<3 THEN M=M+12:Y=Y-1
100 W=D+2*M+INT(3*(M+1)/5)+Y+INT(Y/4)-INT(Y/100)+INT(Y/400)+2
110 X=W-7*INT(W/7)
120 PRINT:PRINT:PRINT
130 PRINT"THE DAY OF THE WEEK IS ";D$(X)
140 END
```

Cash register.

```
1 OPEN 4,4
2 GET A$:IF A$="" THEN 2
3 READ A$:PRINT#4,A$
4 PRINT#4
5 READ A$:PRINT#4,A$
6 PRINT#4
7 PRINT#4
10 REM
20 GET A$:IFA$=""OR(VAL(A$)=0ANDA$<>"+"ANDA$<>"-"ANDA$<>"="ANDA$<>"0")THEN 40
30 GOTO 100
40 IF A$<>"." THEN 20
100 IF A$="+" THEN T = T + VAL(V$):GOSUB 1000   :GOTO 20
110 IF A$="-" THEN T = T - VAL(V$):GOSUB 1000:GOTO 20
120 IF A$="="THEN 150
130 V$=V$+A$:PRINT"□";V$:PRINTT
140 GOTO 20
150 PRINT#4
160 PRINT#4,SPC(8);RIGHT$((" "+STR$(T)),10)
170 CLOSE 4
180 RUN
1000 IF A$="-" THEN V$=V$+" -":GOTO 1020
1010 V$=V$+"  "
1020 V$=RIGHT$((" "+V$),10)
1030 PRINT#4,SPC(10);V$
1040 V$=""
1050 RETURN
2000 DATA LINE OF TEXT FOR BEGINNING
2010 DATA LINE OF TEXT FOR BEGINNING
```

Sample Run.

```
READY.
LINE OF TEXT FOR BEGINNING
LINE OF TEXT FOR BEGINNING

              1.25
              2.35
              4.25
              5.00

             12.85
```

Cash register

IF YOU WISH to use the Commodore Pet as a cash register this program by John Kingman of Brighton, Sussex will let you do so. Before you run the program, you should set the two lines of data, lines 2000 and 2010, to whatever you want printed at the top of the receipt: for example, name, address, date, etc. These lines should be set

2000 DATA . . . line . . .return

When you run the program, it will wait for you to press a key, then print out your two lines of text before letting you input a number. Your number should not be terminated by a return, but by a + sign if you want the number added, or a − sign if you want the number subtracted.

Each number should be terminated in this way, until the last when, after pressing the + or − signs to input the number, you should press the = sign to print the total. As soon as you press another key, it will go back to the beginning and reprint the titles, and start again. You can exit at any time by using the Run/Stop key.

Calendar routine

THIS SHORT PROGRAM by Clifford Hancock of Bath will find the day of the week from a given date. There should be no restriction on the year that can be input. The past lower limit is 1752, when a change was made from the Julian to Gregorian calendar.

Though written for a Pet the program should translate very easily to run on any microcomputer. The information required is the day, month and year in that order, with the year being entered in full. The algorithm used is based on that given by Knill and Fawcett in the September issue of *The Mathematics Teacher.*

Entering machine code

RECENTLY I had to convert a machine-code program for use within a Basic program, using the machine-code as Data statements in the usual way, writes L R Bloxidge of Solihull, West Midlands. This would have involved the conversion of the hex machine code to decimal and retyping in the Basic lines.

My short program will do this without any effort, the data lines being entered automatically. On running the program, the line number to start the Basic lines is entered in. It should be a four-figure number; if five-figure numbers are required, alter the 4 in line 100 to 5, the 18 in line 130 to 17, and add another space in line 120.

The starting address of the code is then entered in decimal. On pressing Return, the first line of Data statements is shown on the screen and the cursor will be flashing over letter A on the third line. If Return is pressed again, the next line will be entered. It is only necessary to press Return for each line of Data statements.

When the figure by the "A=" is the decimal address of the end of the code + 1, then the lines are complete. If this figure is exceeded, then the required number of data items are removed in the usual manner. If a toolkit is available, lines 10 to 190 are then deleted and further lines added to Poke the data into memory from the Basic program.

The program was written for a Pet with Basic 2, but for old-ROM users the 158 and 623 in line 190 should be altered to 525 and 527. The characters in the square brackets are cursor control symbols, they are

(continued on page 182)

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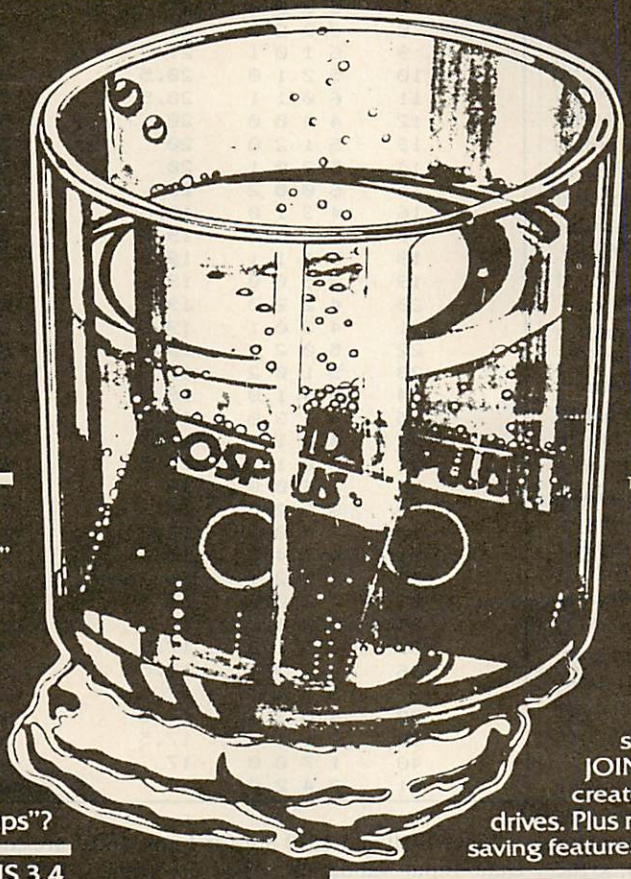

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(continued from page 180)

CL — Clear screen
H — Home cursor
D — Cursor down
U — Cursor up
SP — Space

Dividend calculator

THIS PROGRAM by Maurice Levy of Purley, Surrey is designed to give the total dividends for any combination of score draws, no-score draws, away wins and home wins within the range 15 to 24 points when a full perm is used. A limit of 20 — any eight from 20 — has been imposed as it is unlikely that anything larger than this would be used since it would cost £62.99, even on Zetters. You can raise this limit if you wish by altering line 1410.

The program is written top-down without any Peeks or Pokes or Pet graphics which should make it entirely portable. Naturally such a program has to include screen-control characters, but in Lines 1070 to 1120 they have all been assigned to variables. Everyone has been in the position of frantically Escaping to clear odd quotes and reverse-graphics messes — this procedure avoids all that. If your computer does not support reverse video you can leave out all the R$ and O$ without affecting the way the program runs. If your CHR$ operator is different, just change to your own CHR$ accordingly and all will be well. The only alterations involved are in Lines 1070 to 1120.

Lines 1300 to 1320 are for screen-display control. Line 1310 is really a Home plus four Cursor-downs. Just as you would initialise a numeric variable with Zero, so the string variable is initialised with a Null. On each iteration D$, Cursor-down, is added to X$, and X$ ends up with four Cursor-downs. Putting a H$ or Home on the front gives you L1$. The number of Cursor-downs is decided by the upper limit of the loop, so when developing a screen-display program it is easier to just change the loop limit than to be constantly involved with the Pet reverse graphics and the Escape key. Some computers do not retain variable values outside their For-Next loop; in this case, a loop should be written and substituted for each of these lines.

Dividend calculator.

1	8 0 0 0	24	42	2 5 0 1	17
2	7 1 0 0	23	43	3 1 4 0	17
3	7 0 1 0	22.5	44	3 2 2 1	17
4	6 2 0 0	22	45	3 3 0 2	17
5	7 0 0 1	22	46	4 0 2 2	17
6	6 1 1 0	21.5	47	4 1 0 3	17
7	5 3 0 0	21	48	1 6 1 0	16.5
8	6 0 2 0	21	49	2 3 3 0	16.5
9	6 1 0 1	21	50	2 4 1 1	16.5
10	5 2 1 0	20.5	51	3 0 5 0	16.5
11	6 0 1 1	20.5	52	3 1 3 1	16.5
12	4 4 0 0	20	53	3 2 1 2	16.5
13	5 1 2 0	20	54	4 0 1 3	16.5
14	5 2 0 1	20	55	0 8 0 0	16
15	6 0 0 2	20	56	1 5 2 0	16
16	4 3 1 0	19.5	57	1 6 0 1	16
17	5 0 3 0	19.5	58	2 2 4 0	16
18	5 1 1 1	19.5	59	2 3 2 1	16
19	3 5 0 0	19	60	2 4 0 2	16
20	4 2 2 0	19	61	3 0 4 1	16
21	4 3 0 1	19	62	3 1 2 2	16
22	5 0 2 1	19	63	3 2 0 3	16
23	5 1 0 2	19	64	4 0 0 4	16
24	3 4 1 0	18.5	65	0 7 1 0	15.5
25	4 1 3 0	18.5	66	1 4 3 0	15.5
26	4 2 1 1	18.5	67	1 5 1 1	15.5
27	5 0 1 2	18.5	68	2 1 5 0	15.5
28	2 6 0 0	18	69	2 2 3 1	15.5
29	3 3 2 0	18	70	2 3 1 2	15.5
30	3 4 0 1	18	71	3 0 3 2	15.5
31	4 0 4 0	18	72	3 1 1 3	15.5
32	4 1 2 1	18	73	0 6 2 0	15
33	4 2 0 2	18	74	0 7 0 1	15
34	5 0 0 3	18	75	1 3 4 0	15
35	2 5 1 0	17.5	76	1 4 2 1	15
36	3 2 3 0	17.5	77	1 5 0 2	15
37	3 3 1 1	17.5	78	2 0 6 0	15
38	4 0 3 1	17.5	79	2 1 4 1	15
39	4 1 1 2	17.5	80	2 2 2 2	15
40	1 7 0 0	17	81	2 3 0 3	15
41	2 4 2 0	17	82	3 0 2 3	15
			83	3 1 0 4	15

Lines 1410 and 1510 are for Limit and Data Input validation. They are rather rudimentary in their present form but adequate against obvious errors. Lines 1530 to 1980 cover the 18 Gosubs to the factorial subroutine which does all the calculations, that is eight from 10, four from six etc. Starting at Line 1530, X is equal to left and Y is equal to the right — eight from 10 is equivalent to X from Y. Changing the values of X and Y with each pass through the subroutine changes the value of CA, and the most recent value of CA is saved in the appropriate variable for later use.

Lines 1990 to 2260 are where all the variables — the various results of CA — are collated, added and multiplied, to obtain the total dividends for n data. An example would be, say 15 points. This would make up from the 18 available variables in 11 sets using 33 variables.

Lines 2280 to 2370 make up a For-Next loop within which the array PT is loaded with the 18 dividends in decrementing ½ points, except the first. Line by line the screen displays the dividend number, a long line and the number of dividends. With the help of a Cursor-up the points are then placed in the middle of the line; Line 2360 does it.

Lines 2380 to 2440 display a three-option menu Print, Redo or End. This will

Entering machine code.

```
10 REM ****************
20 REM * BASIC LOADER *
30 REM ****************
40 REM L.R.BLOXIDGE
50 REM
60 REM TO PRODUCE BASIC DATA LINES
70 REM FROM RESIDENT M/C CODE.
80 REM
90 REM
100 INPUT"[CL]BASIC STARTING LINE NO. (4 FIGS.)";LN
110 INPUT"[DJM/C CODE START (DEC)";A:PRINT:PRINT
120 PRINT"[CL][D3][SP4]DATA";
130 FORI=1TO18
140 R$=STR$(PEEK(A)):R1$=RIGHT$(R$,LEN(R$)-1)
150 PRINTR1$",";:A=A+1:NEXT:PRINTCHR$(20)
160 PRINT"A=";A":LN=";LN+10":GOTO120"
170 PRINT"[U4]"
180 LN$=MID$(STR$(LN),2):PRINTLN$;:LN=LN+10
190 PRINT"[H]":POKE158,1:POKE623,13
READY.
```

Dividend calculator.

```
POOLS DIVIDENDS
MATCH DATE 22 AUG 82
8 FROM 20

   SCORE DRAWS 8      NOSCORE DRAWS 3      AWAYS 4      HOMES 5

                DIVIDEND      POINTS      NO. OF DIVIDENDS
                   1          24              1
                   2          23             24
                   3          22.5           32
                   4          22            124
                   5          21.5          336
                   6          21            644
                   7          20.5         1232
                   8          20           2128
                   9          19.5         3864
                  10          19           4970
                  11          18.5         7280
                  12          18           9366
                  13          17.5        11592
                  14          17          12068
                  15          16.5        12992
                  16          16          13314
                  17          15.5        11760
                  18          15           9948
```

Dividend calculator.

```
1000 REM  ############################
1010 REM  # FULL PERM DIVIDEND CALC #
1020 REM  #       MAURICE LEVY       #
1030 REM  #            1982          #
1040 REM  # CBM 8032 - PRINTER 4022 #
1050 REM  #    PROGRAM 6.2 KBYTE     #
1060 REM  ############################
1070 R$ = CHR$(18)  :REM REVERSE ON
1080 O$ = CHR$(146) :REM REVERSE OFF
1090 U$ = CHR$(145) :REM CURSOR UP
1100 D$ = CHR$(17)  :REM CURSOR DOWN
1110 H$ = CHR$(19)  :REM HOME
1120 C$ = CHR$(147) :REM CLEAR SCREEN
1130 DE$ = R$+" ERROR - DATA INPUT "
1140 RE$ = R$+" ERROR - OUT OF RANGE "
1150 PO$ = R$+" PRINT "+O$+" = P"
1160 DR$ = R$+" RE DO "+O$+" = RETURN"
1170 EN$ = R$+" END   "+O$+" = E"
1180 HL$ = "____________"
1190 PD$ = "POOLS DIVIDENDS"
1200 MA$ = "MATCH DATE "
1210 EF$ = "8 FROM"
1220 DV$ = "DIVIDEND      "
1230 PN$ = "POINTS        "
1240 NV$ = "NO. OF DIVIDENDS"
1250 WK$ = "WORKING"
1260 SD$ = "   SCORE DRAWS"
1270 NS$ = "   NOSCORE DRAWS"
1280 AW$ = "   AWAYS"
1290 HW$ = "   HOMES"
1300 BL$ = "              "
1310 X$="": FORI=1TO24: X$=X$+D$: NEXT: L$=H$+X$
1320 DIM ND$(18),PT(18)
1330 PRINT C$R$" POOLS DIVIDEND CALC PROG "
1340 PRINT R$  " 18 DIV - 15 TO 24 POINTS "
1350 PRINT R$  "      MATCHES 20 MAX      "
1360 PRINT D$ D$ D$
1369 REM ** DATA INPUT **
1370 INPUT "MATCH DATE      ";MD$
1380 INPUT "No OF RESULTS   ";NR:PRINT
1390 IF NR<8 OR NR>20 THEN PRINT LEFT$(L$,11) RE$ :GOTO2370
1400 INPUT "SCORE DRAWS     ";SD
1410 INPUT "NOSCORE DRAWS   ";NS
1420 INPUT "AWAY WINS       ";AW
1430 INPUT "HOME WINS       ";HW:PRINT C$;
1440 GOSUB 2720:PRINT
1450 PRINT EF$ NR; SD$ SD; NS$ NS; AW$ AW; HW$ HW
1460 GOSUB 2720 :PRINT L$;
1470 GOSUB 2720 :PRINT O$;
1480 SW=SD+NS+AW+HW
1490 IF SW<>NR THEN PRINT LEFT$(L$,11) DE$ :GOTO2370
1500 PRINT LEFT$(L$,5) WK$
1509 REM ** GET FACTORIAL CALCS **
1510 X  = 8 : Y = SD : GOSUB 2620
1520 TQ = CA         : REM 8 SD
1530 X  = 7          : GOSUB 2620
1540 GE = CA         : REM 7 SD
1550 X  = 6          : GOSUB 2620
1560 KI = CA         : REM 6 SD
1570 X  = 5          : GOSUB 2620
1580 OM = CA         : REM 5 SD
1590 X  = 4          : GOSUB 2620
1600 SQ = CA         : REM 4 SD
1610 X  = 3          : GOSUB 2620
1620 VT = CA         : REM 3 SD
1630 X  = 2          : GOSUB 2620
1640 AX = CA         : REM 2 SD
1650 X  = 8 : Y = NS : GOSUB 2620
1660 AP = CA         : REM 8 NSD
1670 X  = 7          : GOSUB 2620
1680 EC = CA         : REM 7 NSD
1690 X  = 6          : GOSUB 2620
1700 IG = CA         : REM 6 NSD
1710 X  = 5          : GOSUB 2620
1720 MK = CA         : REM 5 NSD
1730 X  = 4          : GOSUB 2620
1740 QO = CA         : REM 4 NSD
1750 X  = 3          : GOSUB 2620
1760 US = CA         : REM 3 NSD
1770 X  = 2          : GOSUB 2620
1780 YW = CA         : REM 2 NSD
1790 X  = 7 : Y = AW : GOSUB 2620
1800 KL = CA         : REM 7 AWAY
1810 X  = 6          : GOSUB 2620
1820 XW = CA         : REM 6 AWAY
1830 X  = 5          : GOSUB 2620
1840 CB = CA         : REM 5 AWAY
1850 X  = 4          : GOSUB 2620
1860 JG = CA         : REM 4 AWAY
1870 X  = 3          : GOSUB 2620
1880 RO = CA         : REM 3 AWAY
1890 X  = 2          : GOSUB 2620
1900 WA = CA         : REM 2 AWAY
1910 X  = 4 : Y = HW : GOSUB 2620
1920 WZ = CA         : REM 4 HOME
1930 X  = 3          : GOSUB 2620
1940 WC = CA         : REM 3 HOME
1950 X  = 2          : GOSUB 2620
1960 WE = CA         : REM 2 HOME
1969 REM ** COLLATE FACTORIAL CALCS **
1970 ND$(1) =STR$(TQ)
1980 ND$(2) =STR$(GE*NS)
1990 ND$(3) =STR$(GE*AW)
2000 ND$(4) =STR$(GE*HW+KI*YW)
2010 ND$(5) =STR$(KI*NS*AW)
2020 ND$(6) =STR$(KI*NS*HW+OM*US+KI*WA)
2030 ND$(7) =STR$(KI*AW*HW+OM*YW*AW)
2040 ND$(8) =STR$(KI*WE+OM*YW*HW+OM*NS*WA+SQ*QO)
2050 ND$(9) =STR$(OM*RO+OM*NS*HW*AW+SQ*US*AW)
2060 PH     =OM*NS*WE+OM*HW*WA+SQ*US*HW+SQ*YW*WA
2070 ND$(10)=STR$(PH+VT*MK)
2080 ND$(11)=STR$(OM*AW*WE+SQ*YW*AW*HW+SQ*NS*RO+VT*QO*AW)
2090 PJ     =OM*WC+SQ*YW*WE+SQ*NS*WA*HW+SQ*JG+VT*QO*HW
2100 ND$(12)=STR$(PJ+VT*US*WA+AX*IG)
2110 PR     =SQ*NS*WE*AW+SQ*RO*HW+VT*US*AW*HW+VT*YW*RO
2120 ND$(13)=STR$(PR+AX*MK*AW)
2130 SP     =SQ*NS*WC+SQ*WA*WE+VT*US*WE+AX*QO*WA+SD*EC
2140 ND$(14)=STR$(SP+VT*YW*WA*HW+VT*NS*JG+AX*MK*HW)
2150 PT     =SQ*AW*WC+VT*YW*AW*WE+VT*CB+VT*NS*RO*HW
2160 ND$(15)=STR$(PT+AX*US*RO+SD*IG*AW+AX*QO*AW*HW)
2170 PU     =SQ*WZ+VT*YW*WC+VT*NS*WE*WA+VT*JG*HW+AX*QO*WE
2180 PZ     =AX*US*WA*HW+SD*IG*HW+SD*MK*WA+AX*YW*JG+AP
2190 ND$(16)=STR$(PU+PZ)
2200 PV     =VT*NS*AW*WC+VT*RO*WE+AX*US*AW*WE+AX*YW*RO*HW
2210 ND$(17)=STR$(PV+SD*MK*AW*HW+SD*QO*RO+EC*AW+AX*NS*CB)
2220 PW     =AX*YW*WA*WE+AX*US*WC+AX*XW+SD*MK*WE+SD*QO*WA*HW
2230 PY     =SD*US*JG+AX*NS*JG*HW+EC*HW+VT*NS*WZ+VT*WA*WC
2240 ND$(18)=STR$(PY+PW+IG*WA)
2249 REM ** SCREEN DISPLAY **
2250 PRINT LEFT$(L$,5) BL$ DV$ PN$ NV$
2260 FOR I=1TO18
2270 I$=RIGHT$(STR$(I),2) :X=LEN(ND$(I))
2280 IF X<7 THEN ND$(I)=LEFT$(BL$,7-X)+MID$(ND$(I),2)
2290 IF I=1 THEN PT(I)=24
2300 IF I=2 THEN PT(I)=23
2310 IF I>2 THEN PT(I)=PT(I-1)-.5
2320 PT$=MID$(STR$(PT(I)),2)
2330 PRINT BL$ I$ HL$ HL$ ND$(I)
2340 PRINT U$ TAB(20) PT$
2350 NEXTI
2359 REM ** OPTIONS **
2360 PRINT LEFT$(L$,11) TAB(60) PO$ : PRINT
2370 PRINT TAB(60) DR$ : PRINT
2380 PRINT TAB(60) EN$
2390 GETZ$:IF Z$="" THEN 2390
2400 IF Z$="E"      THEN 2600
2410 IF Z$=CHR$(13) THEN RUN
2420 IF Z$<>"P"     THEN 2390
2429 REM ** PRINT-OUT **
2430 OPEN4,4
2440 PRINT#4, PD$
2450 PRINT#4, MA$ MD$
2460 PRINT#4, EF$ NR
2470 PRINT#4,
2480 PRINT#4, SD$ SD"  "NS$ NS"  "AW$ AW"  "HW$ HW
2490 PRINT#4,
2500 PRINT#4,,,DV$ PN$ NV$
2510 FORI=1TO18
2520 I$=RIGHT$(STR$(I),2)
2530 PT$=MID$(STR$(PT(I)),2)
2540 SL$=LEFT$(HL$,(LEN(HL$)-LEN(PT$)))
2550 PRINT#4,,,I$ HL$ PT$ SL$ ND$(I)
2560 NEXTI
2570 FORI=1TO32 :PRINT#4 :NEXT
2580 CLOSE4
2590 GOTO 2390
2600 PRINT C$ R$ " E N D   P R O G R A M "
2610 END
2619 REM ** FACTORIAL SUB-R **
2620 A=1 : B=0
2630 B=B+1
2640 A=A*B
2650 IF B<X THEN 2630
2660 C=1 : D=Y-X
2670 D=D+1
2680 C=C*D
2690 IF D<Y THEN 2670
2700 CA=C/A
2710 RETURN
2719 REM ** DISPLAY LINES **
2720 FOR I=1TO79: PRINT R$ " "; :NEXT
2730 RETURN
READY.
```

appear on completion of each display with or without Error messages. Lines 2450 to 2580 are the printout section. In the interest of portability it is written in the simplest form and will work whether you use Print or LPrint. Ranging right of number of dividends is done by Line 2560 with a little help from line 2550.

Having keyed in the program, check your first run against the specimen, using the same data. If there is an error the obvious recheck starting points will be Line 1990 followed by 1530.

In the points range 15 to 24, using 1, 1.5, 2 and 3 points with eight matches, there are 83 valid combinations from a possible 6,561 and an additional program had to be written to extract the correct 83 and validate the calculations in Lines 1990 to 2260.

Owners of 40-column machines should make the following changes:

Line 1180 — Shorten HL$

Lines 1190-1290 — Abbreviate headings

Line 1470 and 2270 — Abbreviate results of 1190-1290

Line 2360 — Reduce Tab

Lines 2380-2400 — Reduce Tabs, Options

Line 2740 — Reduce For-Next limits to 39

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Books for Pet lovers

Michael Trott looks at a selection of books on these machines.

PERHAPS ONE DAY we will reach the stage when all the new computer user will have to do is to switch on and sit back while the computer introduces itself, explains how it operates and how to use it, how to program, where to contact other users and how to attach external devices. Until that time authors and publishers will carry on releasing a mixed bag of books on the subject, and the battle for bookshelf space will continue unabated.

A beginners' book aptly enough called *The Pet Personal Computer for Beginners* by Seamus Dunn and Valerie Morgan is aimed at the non-mathematically inclined user. It is suitable for all models from the 2001 to the 80-column version and is priced at only £4.95. The authors have produced a sound introduction to the Pet and programming in Basic to bridge the gap between the manufacturer's manual and a Basic text.

Dunn and Morgan's book is clearly written and covers starting up, programming, particularly cursor functions, reverse field, saving programs and an introduction to Peek and Poke. Exercises for the reader are provided with answers — rectifying a common and infuriating omission in texts of this kind. Information on disc management, reserved words, and graphics and character-set information are provided in appendices. The final chapter makes practical suggestions for using a Pet in the classroom. Though there is nothing really enw or inspiring in the book the authors have successfully taken an established product and produced a no-frills explanation for the possibly wary potential user.

Illegible listings

Anyone who has used a Pet will be familiar with the unique symbols which represent cursor controls and make listings so difficult to read. Dunn and Morgan have avoided this problem by using arrows and lower-case letters in heavier type to represent the cursor-control keys, reverse field, etc.

Unfortunately, Richard Haskell, author of *Pet/CBM Basic* has not demonstrated the same forethought. Even worse, the listings are taken from photographs of the monitor screen — rather than printout — and are therefore rather difficult to read. Where Dunn and Morgan follow a teach-yourself approach, Haskell's book is intended more as a course text for schools and further-education institutions where Pets are available. While both books cover much the same ground, a higher level of mathematical ability is assumed though the author provides a more comprehensive explanation of the concepts involved. In particular, the treatment of loops goes further than many similar books, explaining the idea of Do-While, Do-Until, Repeat-While and Repeat-Until loops and how they function in Basic. The author's use of the idea of train tracks with branch lines and stations is a clear and sensible way of illustrating the concept.

Origins in U.S.

Strings and arrays are also handled competently by Haskell, although the obvious American origin of the material and the use of the American flag and dollars and cents in the examples would prejudice many teachers against using his book in British schools. When will publishers acknowledge that examples provided in books used in schools need to be written within the range of a child's experience to be effective? It would surely not take much effort to revise American publications — and software too, for that matter — for intended consumption in our schools. They might also care to revise their prices; at £10.35 for a 154-page paperback the book does not represent particularly good value for money.

So now you have your Pet and you can write programs, but you would like a program for a particular application. There are two solutions to the problem: write it yourself or try to track down a program written by someone else that you can use or adapt. To help you track down programs and articles for the Pet, Michael Ryan has compiled *The Pet Index*. Covering 290 issues of 17 publications the *Pet Index* gives over 2,100 references to articles, games, programs, devices, books and languages for the Pet and Vic-20. Each reference provides details of author, dates, source and language used, as well as the price, if known. The entries are classified under subject headings for easy reference, and addresses for obtaining back copies and magazine subscriptions are also provided.

The Pet Index is undoubtedly a useful guide both for the home computer enthusiast and for those with technical or business applications in mind. At £12.50 it may seem expensive, but it could save you a great deal of time and money. Persuade your local library to buy it.

Often one comes across interesting programs written for other micros. Converting them to run on your own machine can be a time-consuming and daunting task if you are not familiar with the peculiarities of a different Basic dialogue. To simplify this job a group of authors calling themselves Brain Bank have provided *The Basic Conversions Handbook for Apple, TRS-80 and Pet* users to assist program conversions between these languages. All commands and reserved words are covered as well as notes on equivalent Peek, Poke and Call statements and conversion charts for screen co-ordinates.

The book follows a standard form: listing command, your machine command, comments. Where no equivalent command exists a comment is provided which usually includes suggestions as to how it may be simulated, perhaps through Poking or by employing one of the user subroutines from the book's appendix. Additional hints and tips on conversion are provided by the authors, making this a very comprehensive and useful habndbook.

Technical talk

Pet Interfacing by James Downey and Steven Rogers is for more technically minded users with some previous knowledge of electronics who wish to build and design specialised interfaces for the Pet. The authors use Basic for the majority of the projects, but provide some assembler listings. *Pet Interfacing* covers the user port, memory expansion port and the IEEE-488. Each example is explained with software and circuit details and experiments are provided to teach the concepts and techniques involved.

The book includes a major project on the construction of a general-purpose listener/talker for the IEEE bus allowing the connection of non-IEEE devices. *Pet Interfacing* provides a thorough and detailed applications text for those with some understanding of microelectronics.

If I had to choose one book from the group it would be *The Basic Conversions Handbook. The Pet Personal Computer for Beginners* would come a close second, as something to lend to apprehensive friends who are new to computing.

The Pet Personal Computer for Beginners by Seamus Dunn and Valerie Morgan
Published by Prentice Hall, £4.95. 242 pages. ISBN 0 13 661827 8.
Pet CBM Basic by Richard Haskell, 154 pages. Published by
Prentice Hall, £10.35. ISBN 0 13 661751 4.
The Pet Index by Michael A F Ryan, 194 pages. Published by
Gower, £12.50. ISBN 0 566 03426 3.
The Basic Conversions Handbook by David Brain, Philip Oviate,
Paul Paquin and Chandler Stone, 80 pages.
Published by Hayden. ISBN 0 8104 5534 X.
Pet Interfacing by James Downey and Steven Rogers, 262 pages.
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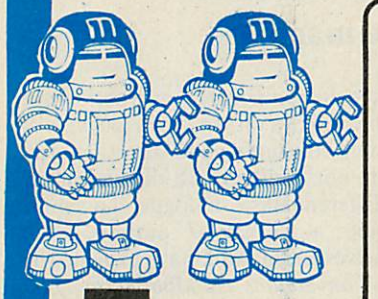

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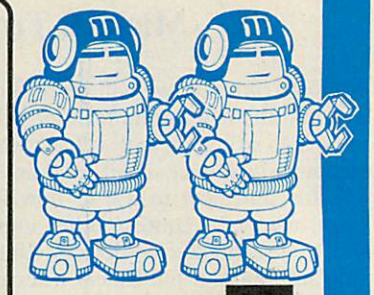

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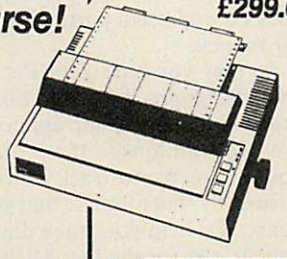

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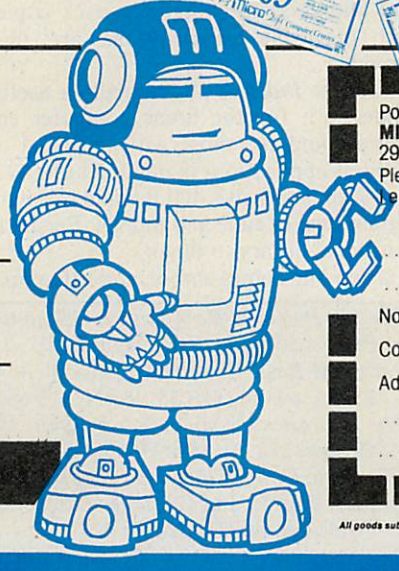

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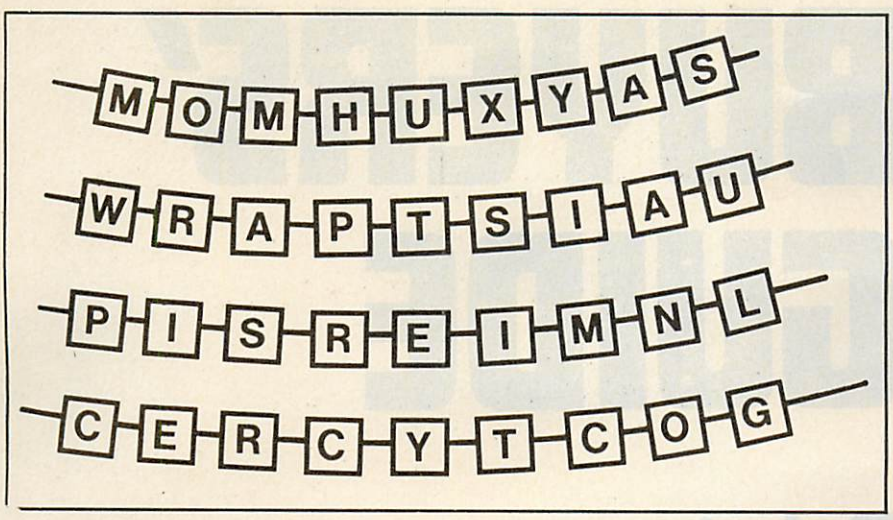


Season's greetings

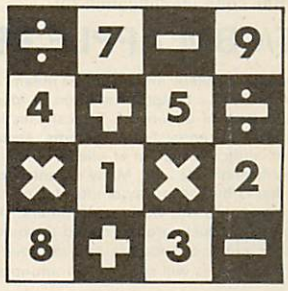
by Tony Roberts

Solution for November

THE GREATEST possible result of the Knight's Square Route puzzle is 45,360, from the sequence:

2 + 4 × 9 × 8 × 7 × 5 × 3 − 1

or any similar sequence.



FOR CHRISTMAS this year we thought you would like a set of decorations: a nice row of cubic beads on a string bearing our seasonal message to you. To make life a little more interesting we are showing only one of the faces of the cubes in each picture. The pictures are not in the right order, and some of the beads were twisted on the string while the pictures were being drawn.

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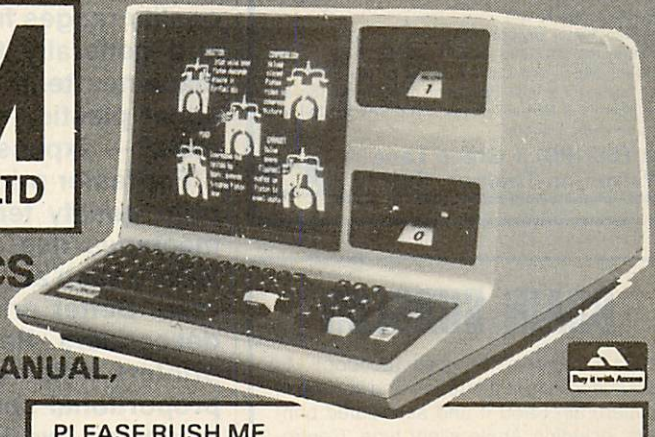

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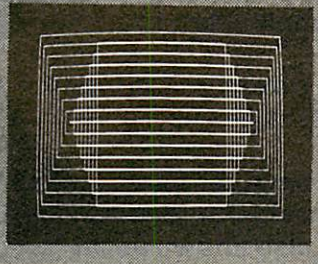

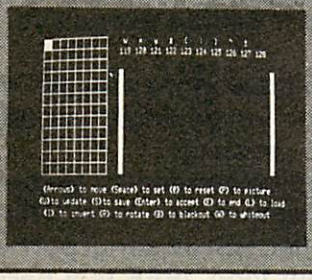

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BUYERS' GUIDE

Printers

The Peripherals Buyers' Guide is a survey of printers suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

Printers may be divided into several categories. The highest-quality printing is produced by the daisywheel-type which creates text in various type-faces, according to the wheel used. The quality ranges from excellent typing to rather poor book printing and generally there is a proportional-spacing facility. Those machines tend to be expensive and slow. Daisywheels can be either plastic — inexpensive, but must be replaced often — or metal — expensive but durable.

For faster printing, you must turn to dot-matrix machines. The print quality tends to be poor and the machines noisy. Older machines use a 7-by-5 matrix which puts the descenders of letters such as 'y' above the line. That makes bulk text difficult to read. Better printers use a matrix nine dots deep to give true descenders. Recently, several firms have produced dot-matrix printers which give an approximation to typewriter printing and proportional spacing. They are less expensive than daisywheel machines, work faster and could well be used for correspondence-quality work.

Some dot-matrix printers employ sensitised paper to produce printing by more direct electrical effects. They are often quiet and fast, but the paper can be expensive, unpleasant to handle and hard to obtain.

The trend is to build more processing power into printers. That means they offer increasingly varied features, so it is hard to categorise them precisely.

A printer has to be connected to the computer by a cable and a more or less standard interface. The normal interfaces are the Centronics parallel, RS232 serial port — also known as the V-24 — and 20mA current loop. IEEE is a parallel interface used by Pet; 'cpl' means characters per line, 'cps' means printing speed in characters per second. Allow five characters to the word.

The more intelligent printer prints as its head moves in both directions across the paper — bi-directional printing. Still more

intelligent ones end the head movement at the ends of short lines. These two features can more then treble the working speed.

Printers use two types of paper: plain paper fed — like a typewriter — pinch- and pin- or sprocket- or tractor-fed with holes along the margins. That paper can be supplied fan-folded or in rolls.

Pinch feeding is more expensive but is convenient for letters. Only a few machines will accept both pinch- and pin-fed paper. It is possible to obtain headed letter paper bonded lightly on to pin-fed, fan-folded computer paper for word processors.

Some printers allow direct control of the print-head to give graphics. KSR means keyboard, send and receive, ASR means automatic send and receive, RO means receive only. KSR machines can be used as electric typewriters in local mode.

Comb or line printers have a whole line's worth of dot hammers so they can print a line of text at a time. They tend to be very expensive and very noisy but produce an enormous quantity of work.

ACCESS DATA COMMUNICATIONS

ADC 1251 *£560*
Matrix printer, continuous paper, £13 per box, 80 or 132 cpl, 125 cps, 7x9 matrix. RS232, Centronics and IEEE interfaces.

ADC 2401 *£1,350*
9x9 dot-matrix printer, continuous paper, 136 cpl, 240 cps, RS232, Centronics and IEEE interfaces. Available from Access Data Communications.

ADDMASTER

400 receive only *£242*
Uses 2.5in. Tally roll paper, 16 cpl, 48 cps. Main U.K. agent Clary Ltd.

420-426 receive only *£246*
Dot matrix grade-one Tally roll paper at £5 for 20 rolls. BCD serial or 10-line serial interfaces, 12 cpl, 36 cps.

AMBER

Amber 2400 *£70*
Low-cost inked-ribbon dot-matrix printer using plain paper rolls. Unusual mechanism involves only four print needles, which oscillate horizontally across paper to build up line of dots. 24 normal-size five-by-seven dot characters per line on 58mm. wide paper at speed of 0.7 lines per second. Upper- and lower-case ASCII set, expanded characters and dot graphics. Acorn, BBC, Pet, TRS-80, UK 101 and ZX interfaces available.
Main U.K. distributor Amber Controls Ltd.

ANADEX

Main U.K. agent Anadex Ltd

DP-500 *from £367*
Dot matrix, tractor feed, parallel interfaces, 18 cpl, 45 cps.

DP-660 *from £700*
Dot matrix, pinch feed for printing labels, uses sprocket feed. Parallel interface. 19 cpl, 57 cps.

DP-750A *from £800*
Dot matrix, RS232C 20mA current loop, 21 cps, 25 cps.

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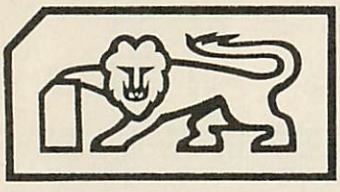

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FP-600 *from £65*
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DP-9500 Series *£895 upwards*
Dot matrix, tractor feed, nine-wire print head, bi-directional printing, three ASCII interfaces as standard — parallel bit, RS232C, current loop — 120-200 cps, 132-220 columns, 7x9, 9x9 or 11x9 matrices depending on model. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

DP-8000 *£550*
Dot matrix, pinch feed, bi-directional printing, fan-fold paper up to 9.5 in. up to three copies. Three ASCII interfaces — parallel bit, RS232C, current loop — 112 cps, 80 column, 9x7 matrix. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

DP-1000 Series *from £395*
Dot matrix, tractor feed, internal data storage, roll-type paper for 40 columns at £11 for box of 10 rolls, three basic ASCII-compatible interfaces are available. 40 cpl, 50 cps, 40 columns, 5x7 matrix. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services.

AXION CORPORATION

Main U.K. agent Memec Systems Ltd

EX-820 receive only *£500*
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CENTRONICS

Main U.K. agents Bytech, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 150 *£499*
Table-top demand document dot-matrix printer, 150 cps, bidirectional logic-seeking, using fan fold, roll and cut sheet paper up to 9.5in. wide 80 columns, RS-232 and parallel models available.

Model 152 *£695*
As model 150, but 132 columns 15in. wide.

Model 352 *£1,400*
Print station; advanced dot-matrix printer, 132 column 200 cps bidirectional logic seeking printer. Three-way paper-handling with built-in single-sheet feeder. Has second printing mode which at 60 cps gives very high-definition letter-quality printing, and high-quality pin addressable.

Model 353 *£1,740*
Print Station; similar to model 352 but with liquid-crystal display for status indication and user-selectable parameter set-up.

Model 739 *£504*
Table-top correspondence-quality mini-printer with three-way paper handling and proportional character set.

Model 6300 *P.O.A.*
Industrial 300 line per minute band printer.

Model 6600 *P.O.A.*
Same as 6300 but with 600 lines per minute.

Model 6080 *£5,583*
Very quiet 600 line per minute band printer for office use. Has a variety of interfaces to suit most micro, mini or mainframe computers.

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Thermal mechanism, uses Thermal Type B paper at £2.40 per roll, RS232 or parallel — 1201 only — interfaces, 80 or 132 cpl, 10/30 cps, 7x5 matrix. Main U.K. agent Teleprinter Equipment Ltd.

DAISY SYSTEMS

Main U.K. agent Peripheral Hardware Ltd
Daisywheel printer *£1,380*
45cps, bidirectional logic seeking. 10- 12- and 15-pitch spacing as well as proportional spacing, giving 132cpl at 12cpi. Plotting resolution is 5,760 per square inch. Handles single sheet paper and fanfold up to 15in. wide. Full range of interfaces.

DATAC

Main U.K. agent Datac Ltd
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DMI-40P free-standing terminal, receive only *£350*
Impact, matrix, uses pressure-sensitive roll paper, 10mm.-wide ordinary paper version, using ink ribbon. Cost of paper £1 per roll, seven-bit parallel ASCII, character serial, RS232C or graphics, 40 or 20 cpl, up to 80 cps, 7x5 matrix.

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411 panel mounting, receive only *£189*
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313 panel-mounting, receive only and *£269*
312 free-standing, receive only
Impact matrix type PU-1100, Tally roll paper, 59mm. wide x 36m. long at 60p per roll, CCITT/V24 or EIA RS232C or 20mA current loop interfaces, up to 20 cpl and up to 36 cps, 7x5 matrix.

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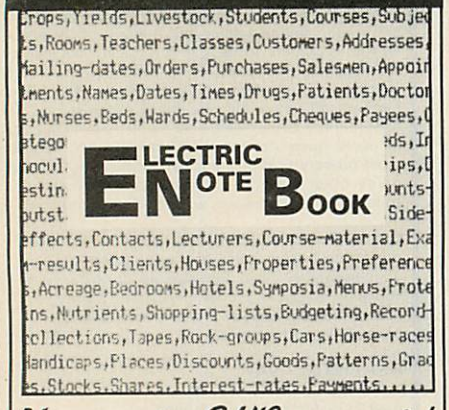

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522/1 and 522/4 receive only — *£499 (522/1) £535 (522/4)*

Impact matrix type, roll paper, 114mm. x 75m. up to three copies plus original, cost of paper £1.10 per roll. Parallel interface and RS232C, 20mA current loop and parallel buttered, asynchronous interfaces — (522/4). 40 cpl, 100 cps instantaneous rate, 33 cps average rate — including CR and LF. 7x5, 7x10.

DATA DYNAMICS

Main U.K. agent Data Dynamics Ltd

303 Printer — *£980*

Dot matrix, up to six-part stationery width from 3m to 15.375in., V24/RS232C, 20mA current loop, 132 cpl, 30 or 60 cps, 7x7 matrix.

ZIP ASR/K7 twin cassette — *£2,000*

Dot matrix format, uses standard Teletype roll paper, V24, RS232C, or 20mA current loop operating at half or full duplex, 80 cpl, 10 or 30 cps switch selected, 5x7 matrix.

ZIP 30 keyboard printer, RO, ASR, or KSR — *ASR £1,800 RO & KSR £950*

Dot matrix, standard roll paper, 20mA half or full duplex current loop or V24 RS232C, 80 cpl, 10 or 30 cps — switch selected, 5x7 matrix.

390 eight-level and 392 five-level — *ASR from £1,250 LSR from £900 RO from £800*

ASR, KSR and read-only versions. Impact printers, friction or sprocket feed, 8.5in. paper with roll diameter 5in. 74 or 86 cpl, 6.6 or 10 cps.

Models 32 and 33 page printers — *ASR from £1,100 KSR from £800 RO from £700*

Available in ASR, KSR and receive-only versions. Friction or sprocket feed, 20mA or 60mA parallel, up to 86 cpl, 6.6 or 10 cps.

DATA GENERAL CORPORATION

Dasher TP1 Printer models 6040 and 6041 — *From £1,598*

6040 standard keyboard and can be used as a typewriter. 6041 is a receive-only terminal printer without keyboard, 30 or 60 cps, switch selectable, EIA-RS232C interfaces, 5x7 dot matrix. Main U.K. agent Data General.

DATAPLUS

400 series receive-only Model 480 — *£475*

Impact dot matrix, uses standard Tally roll, up to 3.75in. side, from 80p per roll, RS232C, V24, 20mA current loop, but parallel IEEE, Pet and Apple interfaces, 30/40 cpl, 110 cps, 7x5 and 7x10 matrices. Main U.K. agent Dataplus Ltd.

DATASOUTH CORPORATION

Main U.K. agent Datatrade Ltd

DS-180 — *£1,360*

Impact, matrix printer, uses fan-fold paper, RS232C, current loop, and parallel interfaces, 132 cpl, 180 cps, 9x7 matrix.

Multimode — *About £1,795*
Dot-matrix printer with three modes of operation as standard: fast 225cps, near letter quality at 40cps, and graphics mode, providing up to 240-by-144 point high resolution. 132cpl, basic dot matrix is 9 by 10. Mode is switch-selectable from front panel. Two paper apertures for continuous tractor feeding or single sheets. APL, Arabic and bar code printing as options. Full range of interfaces.

DIABLO

HY type II receive only — *P.O.A.*
Impact daisywheel plastic or metal print wheel, parallel, interface, 132 10-pitch cpl or 158 12-pitch cpl, 40/45/55 cps. Main U.K. agent Diablo Systems Ltd.

630 receive only — *£1,725*
Daisywheel, metal/plastic printwheels, standard listing or single sheet paper, RS232C, V24 with optional bus interface, 132 cpl at 10 pitch, 158 cpl at 12, 198 cpl at 15, up to 40 cps with automatic bi-directional printing. Main U.K. agent Geveke Electronics.

DIGITAL EQUIPMENT

DecWriter LA34 KSR — *£824*
Dot matrix, uses roll or fan-fold paper, friction-feed, up to five copies, RS-232 or 20mA interfaces, adjustable up to 256 cpl, 30 cps, 7x9 matrix. Main U.K. agent Bytech.

A120 — *from £1,645*
7x7 dot matrix, EIA or 20mA option, up to 217 cpl, 180 cps. Main U.K. agent Bytech.

DIGITRONIX

Mini-Printer — *£195*
32 column electro-sensitive, 110-4,800 baud, ASCII Serial inputs at RS232C, 20mA, 64 font at 64 cps. Main U.K. agent Digitronix.

DRG

Starwriter FP1500-25 — *£923*
96-character daisywheel printer. Up to 136 cpl, 25 cps, RS232 interface, compatible with sheet feeders. Self-testing, programmable vertical format unit. Available from DRG Business Machines.

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EG-800 receive only — *from £450*
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500 series receive only — *from £175 for mechanism only*
Impact, matrix printer, uses 3.5in. Tally roll paper and flat documents, serial or parallel interfaces, 40 cpl, 120 cps, 7x5 or 7x6 matrices. Main U.K. agent Electrographic AV Ltd.

EPSON

Main U.K. agent Epson (U.K.) Ltd
MX-80 Type III — *£400*
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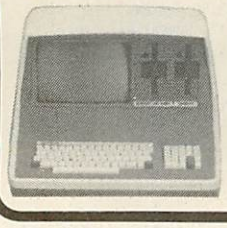

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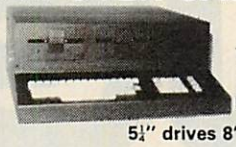

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PC12

● Circle No. 271

Practical Computing

Next Month

Like pocket calculators, micros are getting smaller, and the portable computer is becoming an important part of the scene. We've been looking at what's available, from the truly pocketable to the just-about-carryable Osborne 1.
PLUS an interview with Adam Osborne, the man who brought portability to business computing.

Fortune 32:16

On test – a high-powered multi-user, multi-tasking micro which offers 8 bits more than the Sirius or IBM PC and comes with UNIX. But it is still under £5000 . . .

Other reviews include the MPF-II, which comes with Apple-type BASIC for under £300, the Jupiter ACE with built-in FORTH, Apple games and Spectrum books.

D.I.Y. Spectrum Interface

How to build and use an analogue-to-digital interface for the Sinclair Spectrum, plus software for drawing graphs and hard copy to printer.

And much more!

Don't miss the January issue of Practical Computing, on sale at your local newsagent after December 15.

PRINTERS

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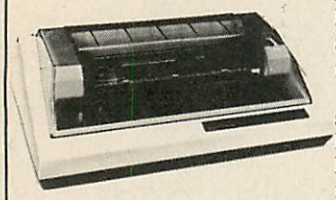

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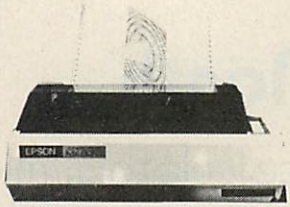

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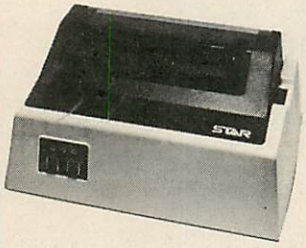

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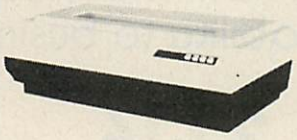

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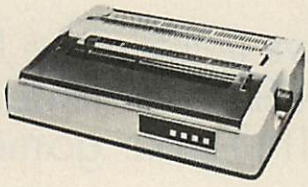

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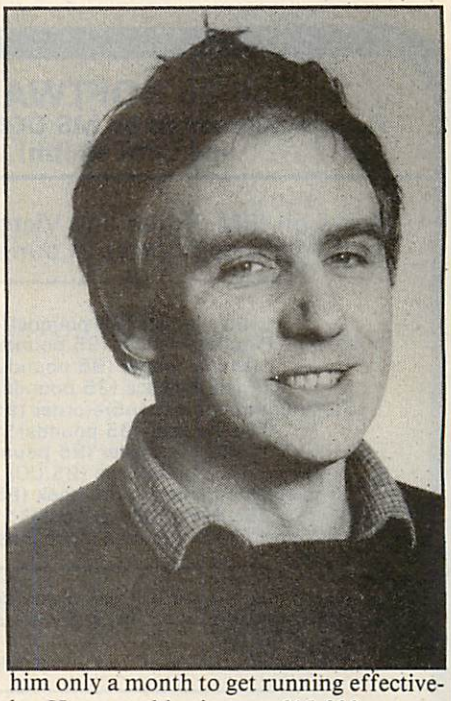
● Circle No. 277

From editor to entrepreneur



CHANGE is often recommended as being as good in its effect as a holiday. What they do not tell you is how long it is until you need another change. Anyway, for your correspondent the change from being an editor to being an entrepreneur is for the moment having the advertised effect.

Someone once remarked that being a journalist would be a wonderful way of earning a living if it were not for the writing, and I didn't even mind that. What did turn out to be tiresome was trying to keep a fix on the formless surge of ideas, concepts, innovations, breakthroughs and world-shattering inventions which poured on to one's desk every morning and once again after coffee.

Each of these turning points in the history of human civilisation was backed by an often hysterical promotor who, quite naturally, thought his own turning point was the one true turning point and paid no attention to the others. The poor journalist should, if he is not to be a mere hack, try to make some sense of all this. But when you ask: "Mr X, why is your watershed in the progress of man superior to Mr Y's culminating peak in the upward march of the human race?", answer usually comes there none. Mr X and Mr Y are too busy to bother with each other's products. Each believes that their own is so vastly superior to any other that comparison would be fruitless.

It's all very difficult for the journalist who tries to hold the ring and has to try to work out who is really competing with whom, and what the true merits are. There's no one to turn to for help. If you ask any of the protagonists why their thing is better than the others' you will get a shirty reply. How could the possibility of a comparison come to his mind? He must understand that the product of the inept and crapulous Mr Y is not even to be mentioned in the same breath as that of the inspired Mr X. As to comparisons — there could be no point.

Well, your scribe has escaped from this perilous moral predicament. He no longer has to make any pretence of impartiality; as an entrepreneur he can join in the fray whole-heartedly, crying up his own admittely superlative products and despising the rest on no better grounds than that they are not his. Yet it is a human duty, so most respectable religions tell us, to strive to improve. This principle may apply even in the realms of computing, though most people there seem to believe that they are exempt from all laws of God, man and civilised behaviour. So in order to improve, I and my small crew are about to take lessons in our rivals' products. Such a step is unprecedented: never before in the history of software has anyone taken such an impetuous step, and we run the grave risk that one of them might be better than ours. "Unthinkable," you cry. But no, gentle reader, it could just be. We encounter the same deadly peril endured by Roman Catholics, that of losing our faith.

The whole exercise may be not only dangerous but fruitless as well. Quite possibly no one cares whether our software is better than the opposition's or not — whatever "better" may mean in such a context. They may even want it to be worse. In fact we have a rival which is, for the moment, doing a little better than we are. It is very much more limited than our little wonder. It can only do a quarter of the things ours can and when it has done them it can't do any more. But this is what customers seem to want. "Give us," they cry, "software that is limited, simple, incapable of expansion, that does not use the power of computing, that is an arithmetic imitation of what we do already on paper; just so long as we can understand the sodding stuff without taking three years out for a degree in computer science."

by Peter Laurie

They are making a point that doesn't seem to have been properly appreciated within the trade. The cost of a micro and its software is only a part of the cost of the whole installation. Quite apart from the money the hapless customer pays out, there is the hidden cost of his own time in getting used to the machine, and the risk he runs when doing anything serious with it, that it may go wrong.

Suppose you have a £1,500 micro and two possible software packages each costing £300. One is dead simple and will do 70 percent of what the customer wants; the other is more complicated and will do 90 percent of it. Which will he buy? The superficial view from inside the software industry would say that he should take the second and get 20 percent more performance for no greater cost. But the customer may well argue to himself that the machine and first package may take him only a month to get running effectively. He costs his time at £15,000 a year, and he has to add the cost of the business he could have been doing instead of wrestling with the machine — quite sensibly, he takes a pessimistic view. Put that at, say, another £3,000 per month. The cost of the simple option is then £1,500 + £300 + £1,250 + £3,000 = £6,050.

He reckons it might take him three months to get the second option going. Its cost is then £1,500 + £300 + £3,750 + £9,000 = £14,550 — two-and-a-half times as much, and eight times the cost of the system as delivered. Paradoxically, the cheapest part of the package, the software, imposes the heaviest invisible costs.

When you try to persuade him to buy the more complicated micro package, you are asking him to spend an extra £8,500 for 20 percent more performance — not a very good proposition when you offered him 70 percent for £6,050 with the first option. No wonder he goes for the cretinous software.

Very few people in our industry seem to have realised that the cost of the customer's time in getting used to the system can easily make the cost of the hardware and software negligible. This is why micros are so much harder to sell than motor cars or video recorders, devices which people already know how to work and whose hidden intellectual costs are trivial compared to the cost of the hardware.

What's the answer? Well, we think we have one. We are working on a system that will blend all sorts of software packages from different suppliers into a whole. Buyers can start simple and work up, so they are not faced with these huge hidden intellectual costs when they take a new package on board. And best of all, we will not have to worry about what the opposition does because, as yet, there is no opposition.

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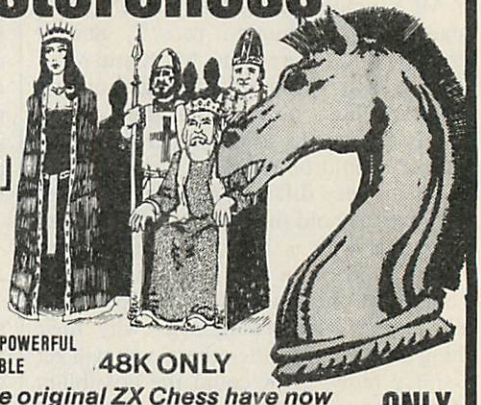

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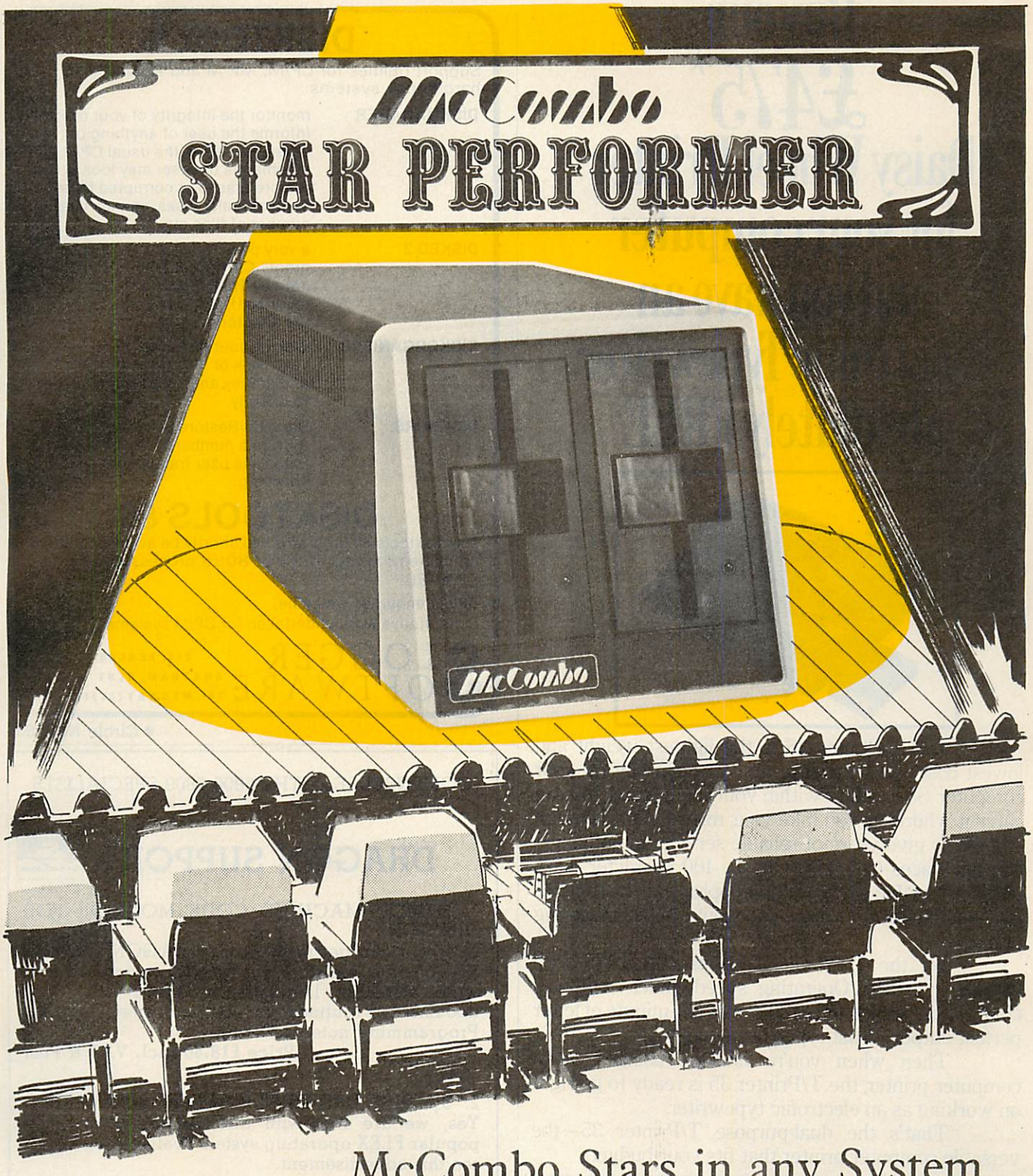

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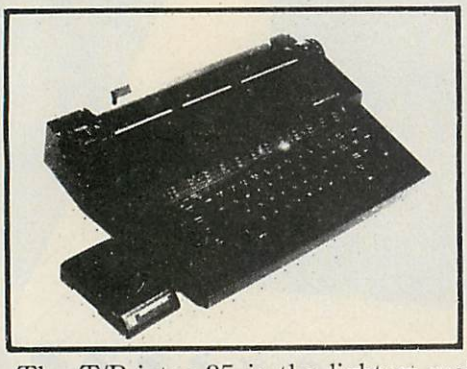

The T/Printer 35 is the lightest weight and lowest cost daisy wheel printer you can buy for your computer. So it will fit within your budget and you can carry it wherever you take your micro. Yet it is tough enough to give years of reliable service. Interchangeable typefaces (standard Olivetti 100 character daisy wheels), variable pitch, multiple copies—all the features you would expect of more expensive word processing printers.

Yet the T/Printer 35 costs only £475 with parallel interface. Operating speed under computer control is approximately 120 words per minute of letter perfect output. What typist can equal that?

Then when you're finished using it as a computer printer, the T/Printer 35 is ready to go right on working as an electronic typewriter.

That's the dual-purpose T/Printer 35—the versatile computer printer that fits your budget.

Orders are shipped within the UK carriage-free. To order or for more information about the T/Printer 35:

**The T/Printer 35 costs £475 with Centronics compatible parallel interface. With RS-232C interface it costs £535. Prices listed are exclusive of VAT.*

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DISKORGANISER	Tidy up your disks just as you do your desk or filing system. Save time and money and hard wear if used frequently.
DISKBURS	Back-Up/Restore your hard disk to/from a number of floppy disks. Extensive user transparent error checking.

DISKTOOLS 86

The disktools 80 programs will shortly be available to run on systems using 8088 or 8086 processors and CP/M-86.

Dealer enquiries welcome.

Consultative work undertaken for CP/M systems.

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74LS12	13p
74LS13	15p
74LS14	25p
74LS15	12p
74LS20	13p
74LS21	13p
74LS22	13p
74LS26	14p
74LS27	13p
74LS28	14p
74LS30	13p
74LS32	13p
74LS33	14p
74LS37	14p
74LS38	14p
74LS42	30p
74LS47	38p
74LS48	45p
74LS51	14p
74LS55	14p
74LS73	18p
74LS74	16p
74LS75	18p
74LS76	18p
74LS83	36p
74LS85	45p
74LS86	16p
74LS90	22p
74LS92	20p
74LS93	22p
74LS95	40p
74LS96	50p
74LS107	20p
74LS109	27p
74LS112	20p
74LS113	20p
74LS114	22p
74LS122	25p
74LS123	34p
74LS124	90p
74LS125	24p
74LS126	25p
74LS132	34p
74LS133	25p
74LS136	25p
74LS138	27p
74LS139	27p
74LS145	70p
74LS147	100p
74LS148	75p
74LS151	40p
74LS153	40p
74LS154	80p
74LS155	30p
74LS156	36p
74LS157	25p
74LS158	30p
74LS160	38p
74LS161	36p
74LS162	36p
74LS163	36p
74LS164	40p
74LS165	50p
74LS166	60p
74LS170	70p
74LS173	55p
74LS174	40p
74LS175	40p
74LS181	90p
74LS183	120p
74LS190	36p
74LS191	36p
74LS192	36p
74LS193	38p
74LS194	35p
74LS195	35p
74LS196	45p
74LS197	45p
74LS221	50p
74LS240	55p
74LS241	55p
74LS242	55p
74LS243	55p
74LS244	55p
74LS245	70p
74LS251	30p
74LS253	30p
74LS257	30p
74LS258	35p
74LS259	55p
74LS260	22p
74LS266	20p
74LS273	55p
74LS279	30p
74LS280	100p
74LS283	40p
74LS293	40p
74LS295	90p
74LS298	90p
74LS299	180p
74LS323	160p
74LS324	150p
74LS348	90p
74LS352	60p
74LS353	60p
74LS356	250p
74LS363	140p
74LS364	140p
74LS365	30p
74LS367	30p
74LS368	30p
74LS373	55p
74LS374	55p
74LS375	70p
74LS377	70p
74LS378	45p
74LS390	45p
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74LS642	100p
74LS643	100p
74LS644	100p
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74S02	30p
74S04	30p
74S05	60p
74S08	60p
74S10	40p
74S11	50p
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74S30	40p
74S32	70p
74S37	60p
74S74	75p
74S85	450p
74S86	180p
74S112	90p
74S113	90p
74S114	90p
74S124	300p
74S132	110p
74S133	60p
74S138	120p
74S139	120p
74S157	250p
74S163	300p
74S174	250p
74S175	320p
74S188	150p
74S189	150p
74S194	320p
74S200	450p
74S201	320p
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4 43MHz	110p
5 00MHz	175p
6 0MHz	150p
6 144MHz	150p
7 0MHz	150p
7 168MHz	175p
8 86MHz	175p
10 00MHz	175p
10 7MHz	150p
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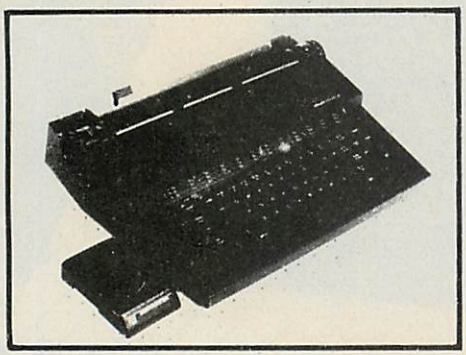

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Tel: 01-590 1155

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Support utilities for CP/M, MP/M and Apple CP/M hard/floppy systems

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74LS26	14p
74LS27	13p
74LS28	14p
74LS30	13p
74LS32	13p
74LS33	14p
74LS37	14p
74LS38	14p
74LS42	30p
74LS47	36p
74LS48	45p
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74LS55	14p
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74LS112	20p
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74LS114	22p
74LS122	25p
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74LS124	90p
74LS125	24p
74LS126	25p
74LS132	34p
74LS133	25p
74LS136	25p
74LS138	27p
74LS139	27p
74LS145	70p
74LS147	100p
74LS148	75p
74LS151	40p
74LS153	40p
74LS154	80p
74LS155	30p
74LS156	36p
74LS157	25p
74LS158	30p
74LS160	38p
74LS161	36p
74LS162	36p
74LS163	38p
74LS164	40p
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74LS257	30p
74LS258	35p
74LS259	55p
74LS260	22p
74LS266	20p
74LS273	55p
74LS279	30p
74LS280	100p
74LS283	40p
74LS293	40p
74LS295	90p
74LS298	90p
74LS299	180p
74LS323	160p
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74LS348	90p
74LS352	60p
74LS353	60p
74LS356	250p
74LS363	140p
74LS364	140p
74LS365	30p
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74S139	120p
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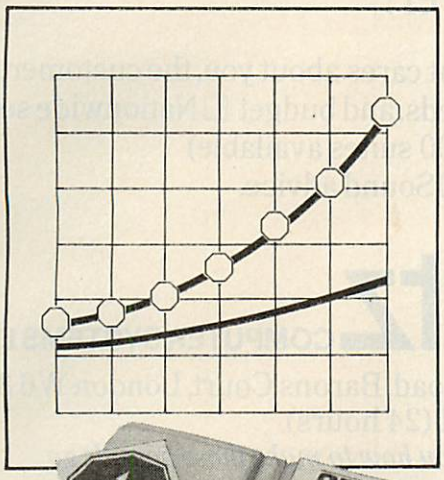

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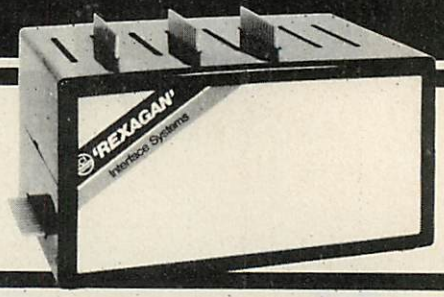

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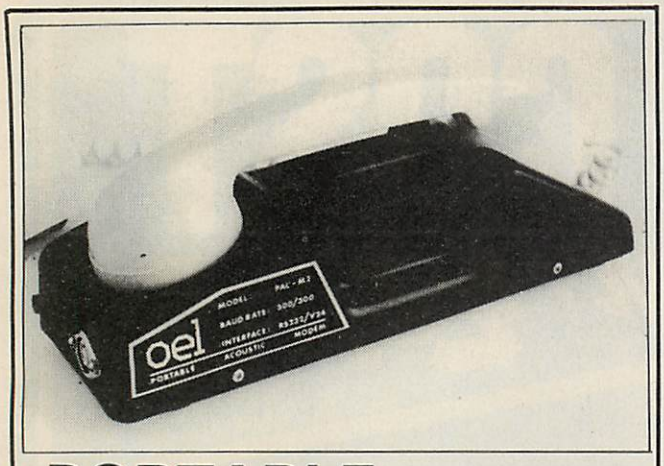

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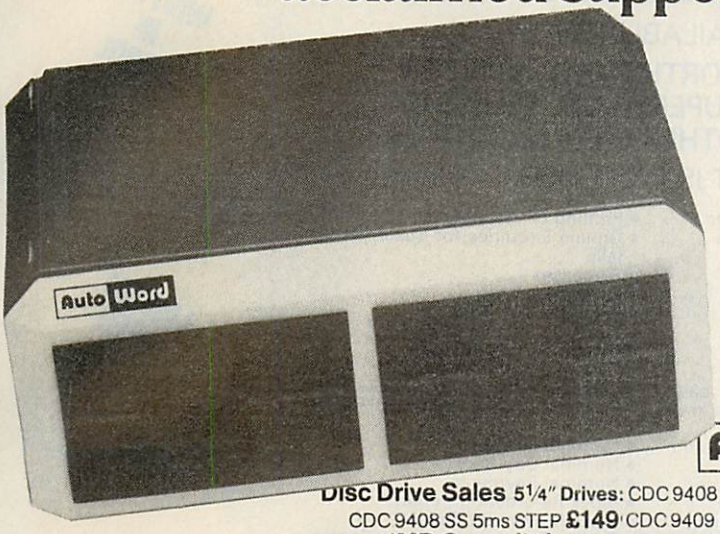

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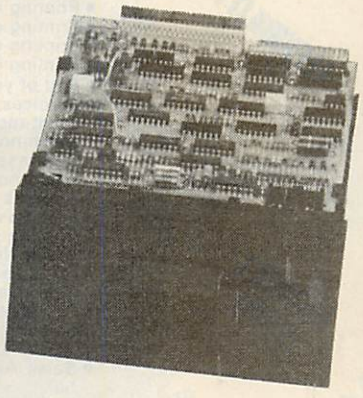

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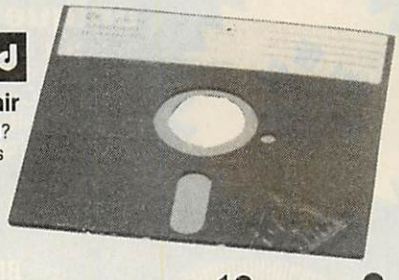

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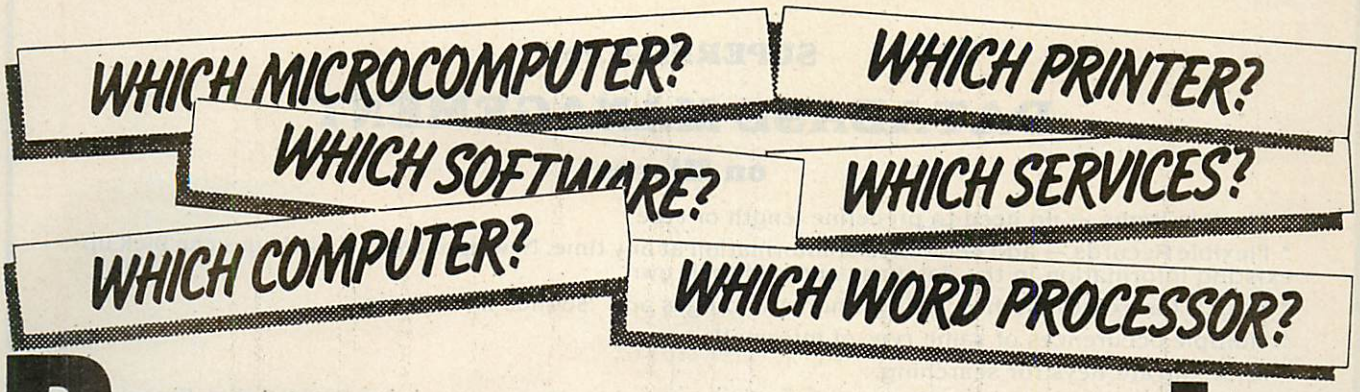

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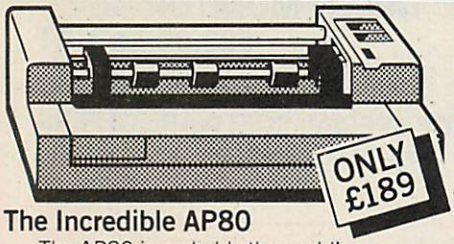

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Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulate any task you wish the program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "sale-mail-shots"; "production-process-analysis"; "patient history analysis"; "research-analysis"; "budgetting"; "purchase/sales-analysis"; "personnel-file-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Previous issues examples have been 'employees prospect files' and 'garage stock re-order reports' here is an example of a sales ledger and several of its reports.

The record may look like this:
1-record number (2)
2-date (12.09.82)
3-invoice (974327)
4-account (2.1 British Mtl)
5-amount (3800.00)
6-vat (570.00)
7-cost of sale (3000)
8-pmt date (03.09)
9-discount status (50.00 unpaid)
10 nomincal code (21.1 general sales)

One report might be: select?? all records and print a list by account priority in ascending order with collated totals showing the trading amount with each client as well as totalling the gross profit made against that client's supplies.

Another report might be: select ?? re-organise the file in nominal code priority ascending order. Print a list of all expense codes with just the collated totals as well as gross profit totals against the same expense heading.

(next issue's example librarian)

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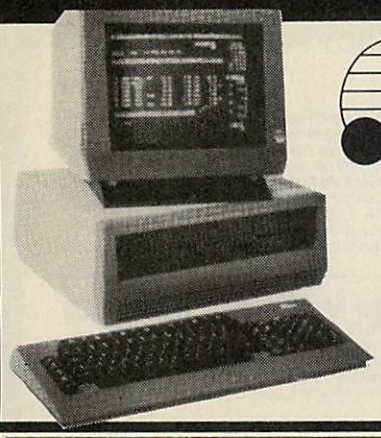

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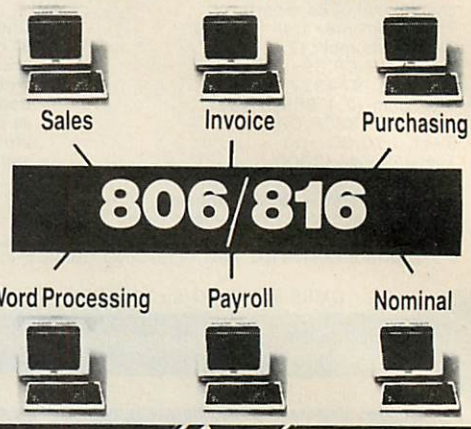

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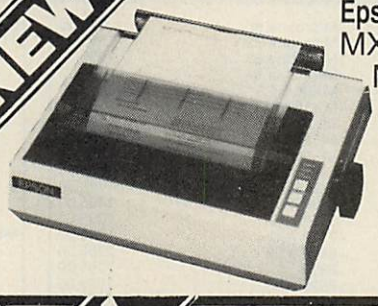

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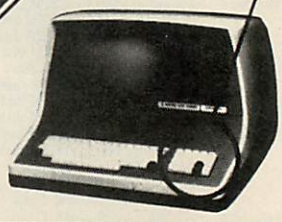

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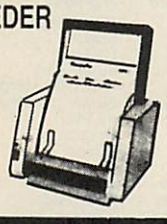

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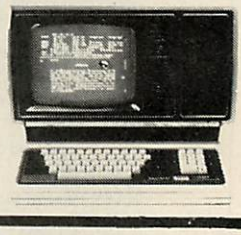

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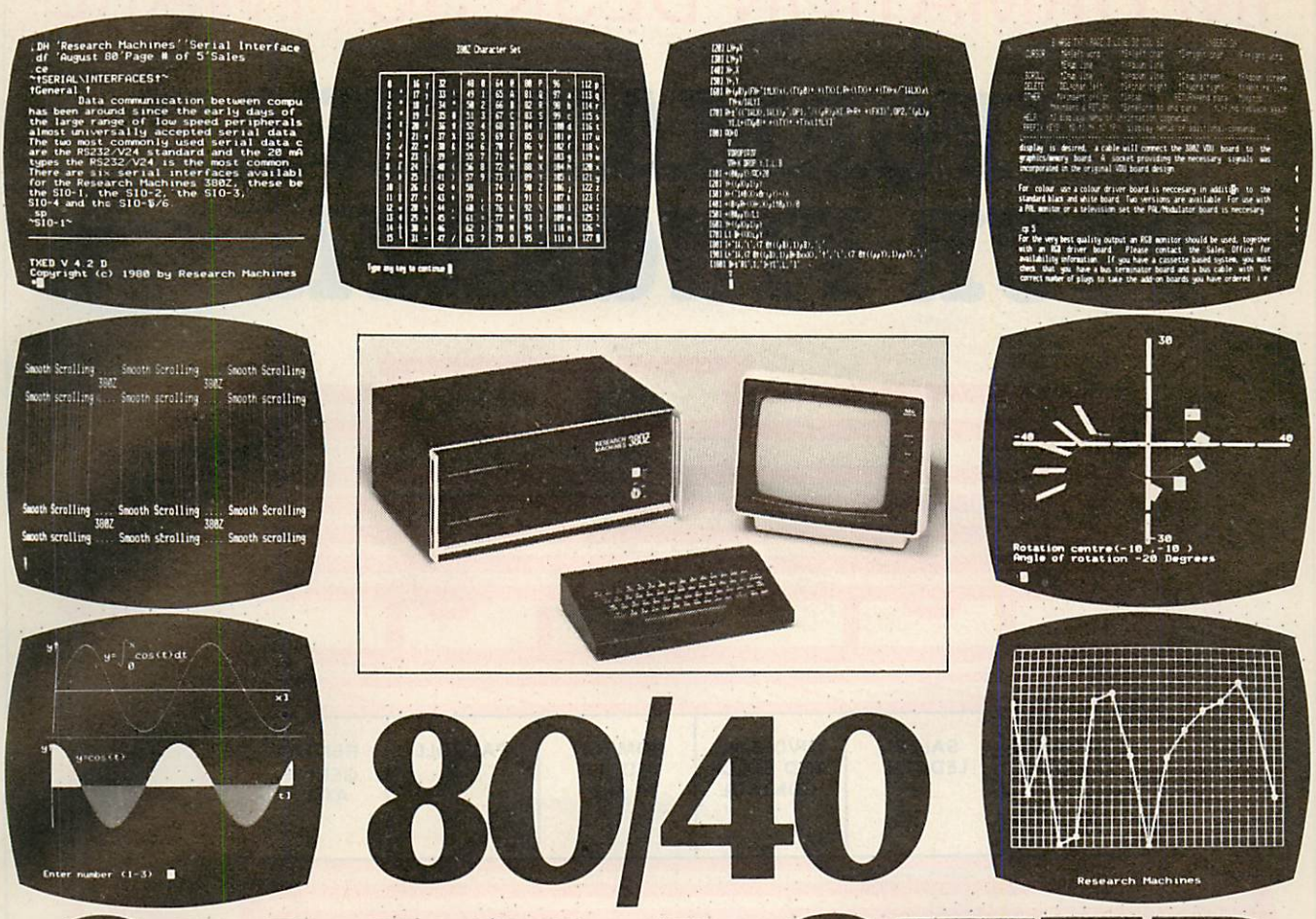

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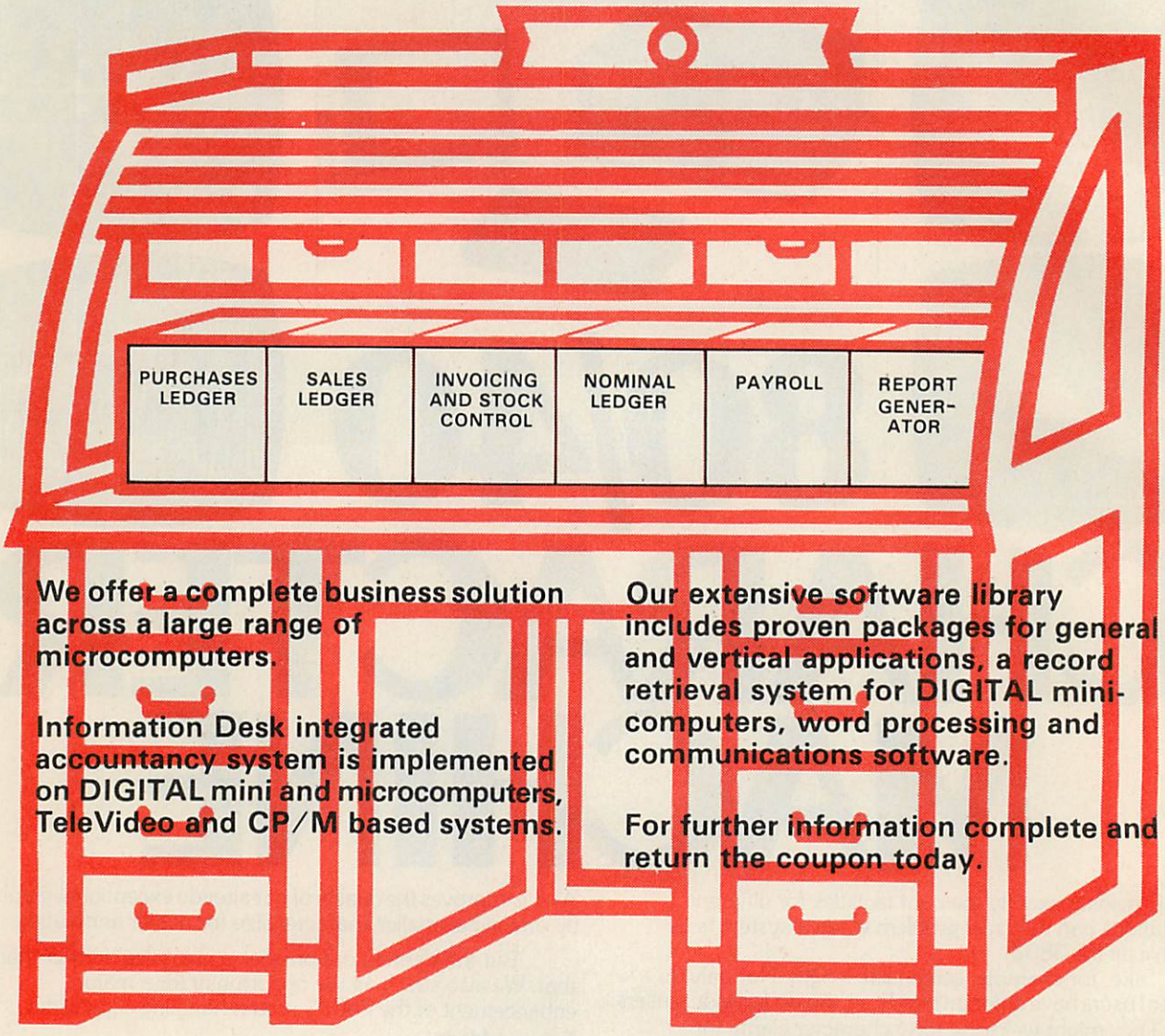

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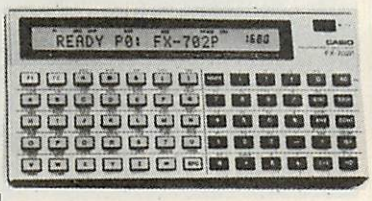

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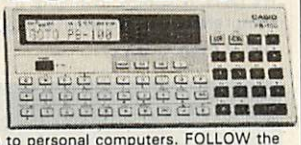

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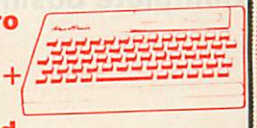

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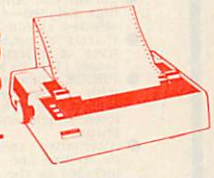

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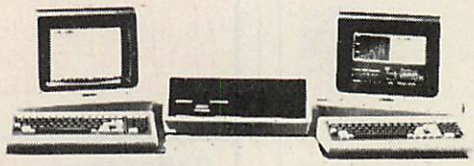

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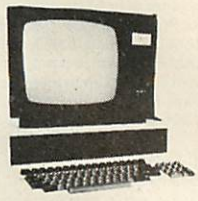

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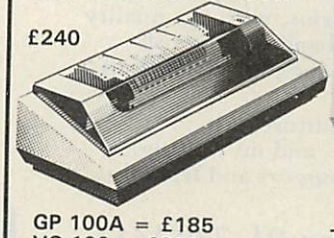

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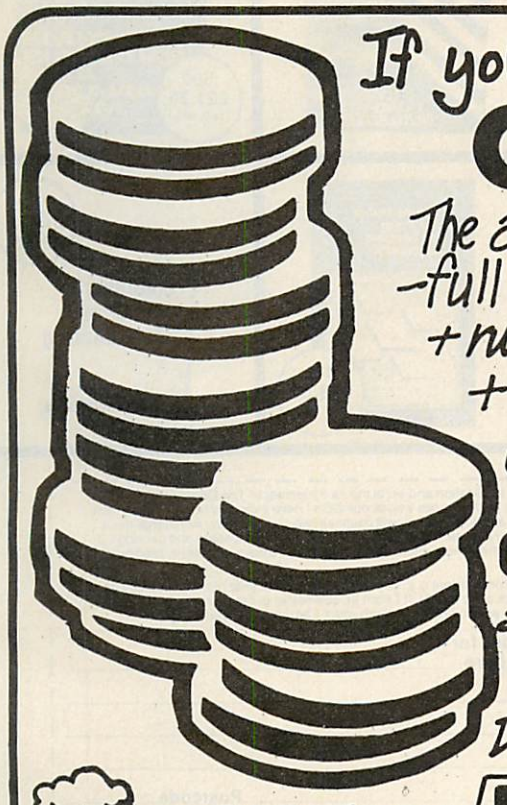

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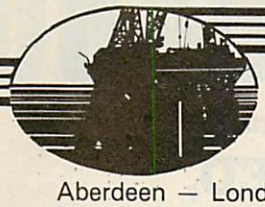

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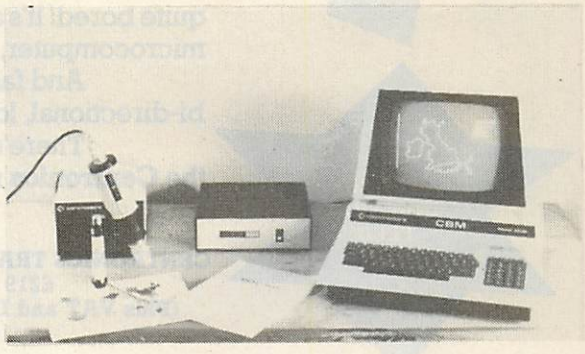

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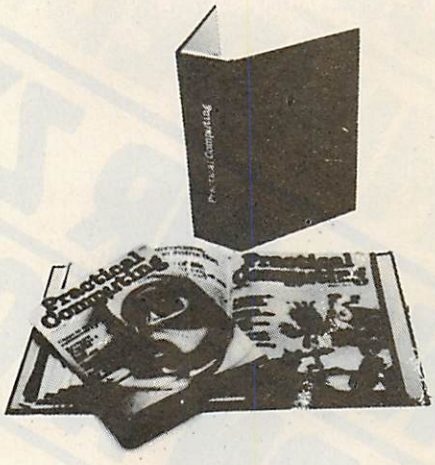

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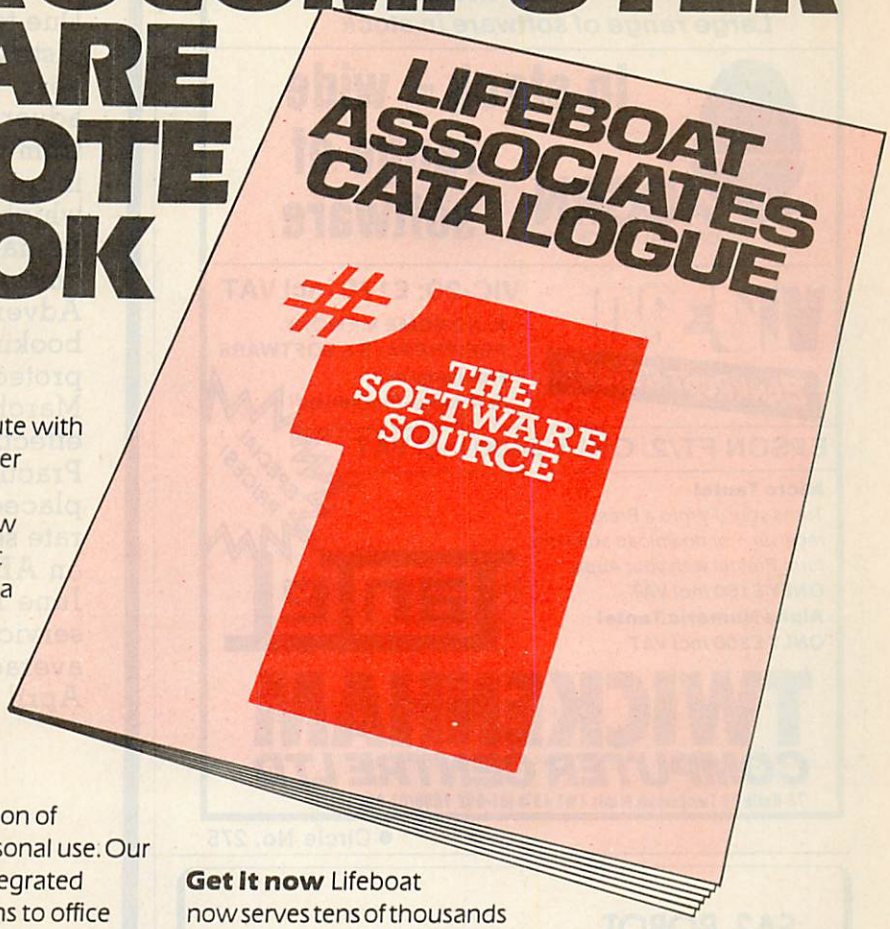

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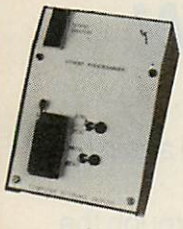

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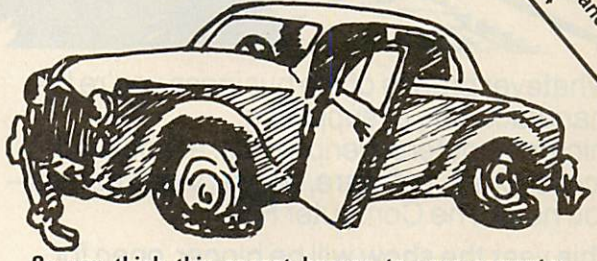

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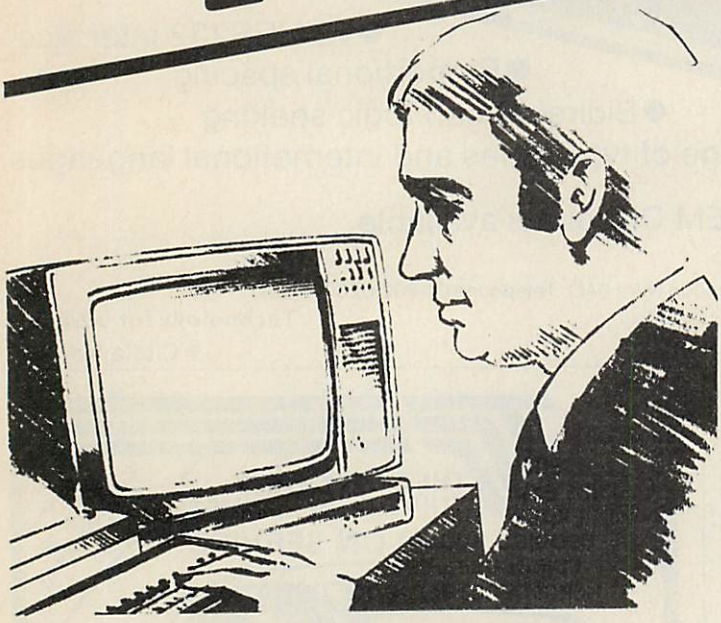

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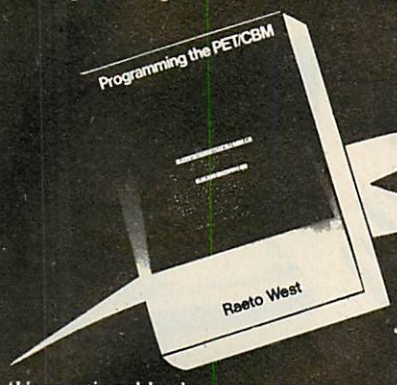

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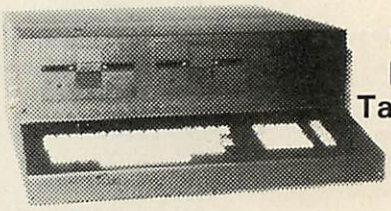

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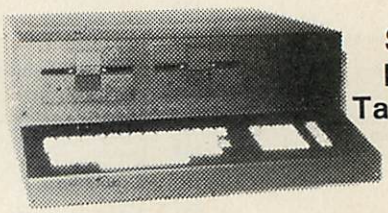

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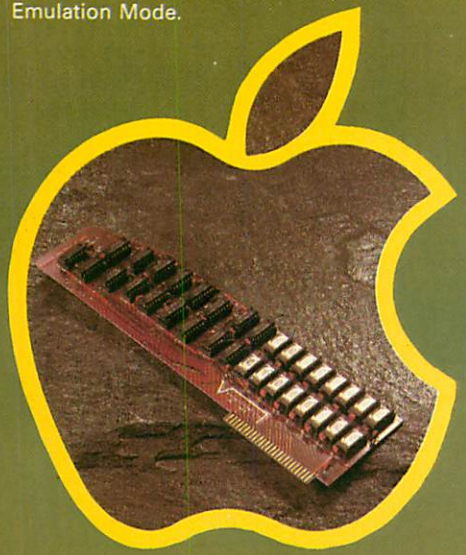

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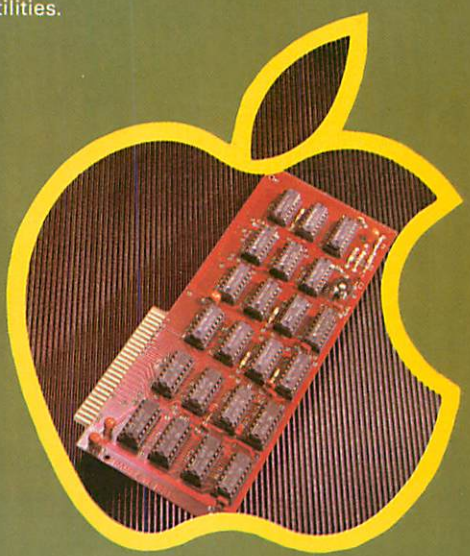

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